SCIENCE

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MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

THE SOCIETY OF AMERICAN NATURALISTS. MEETING OF THE CENTRAL BRANCH.

THE Central Branch of the Society of American Naturalists held its annual meeting at the University of Michigan during Christmas week, the American Zoological Society, the Association of American Anatomists, the American Physiological Society, the Society of American Bacteriologists, the Society for Plant Morphology and Physiology, and the Botanists of the Central States meeting in conjunction with it. About 150 members were present, and on the evening of December 28 the societies were entertained by the president and regents of the university at a reception at which, after an address of welcome by President Angell, the president of the Naturalists delivered his address, which appears in this number of SCIENCE.

The officers for the current year are: President, Dr. J. Playfair McMurrich, of the University of Michigan; Secretary, Dr. W. J. Moenkhaus, of the University of Indiana.

ADDRESS OF WELCOME BY PRESIDENT ANGELL.

Ladies and Gentlemen: I am glad to know that I can properly use this familiar style of address. For I see before me several ladies who have by their learning fairly earned their place in this society of scientists.

In the name of the regents and the faculties of the university I extend to you all a hearty welcome to our halls. We thank you that you have done us the honor to choose this as your place of meeting. We are proud to see under our roof so many eminent representatives of colleges, universities and learned societies, so many who have by careful study and investigation done much to enlarge the boundaries of human knowledge.

Perhaps you will permit me as your senior to say that when I look back to my college days—now nearly three score years in the past—nothing is more striking to me than the change which has been wrought in the attitude and methods of the teachers of science in our schools of higher learning.

In my student days in the curriculum of the best colleges a very brief period, from six to twelve weeks, was given to any science. The instruction consisted mainly in compelling students to memorize text-books. A few illustrative lectures with experiments performed by the professor were sometimes given, which often instructed us by their failure rather than by their success. Laboratories there were none in any institution. The professors who made any original investigation or who betrayed any knowledge much beyond the range of the text-books were not numerous. From such teaching not much inspiration could be expected.

One of the first men to startle us and inspire us by the revelation of new methods was Louis Agassiz. He accomplished this not alone by his training of pupils at Cambridge and Penikese, but by his popular lectures. As I recall some of these I feel again kindling within me the glow of enthusiasm with which we listened to him, as with his winsome French accent he told us of the development of animal life, and with his skilful and rapid drawing he made a fish fairly flop out of the blackboard. His enthusiasm for research was contagious and soon we had votaries of all the sciences questioning nature at a hundred points.

From those days progress was rapid. And so now the spirit of research is dominant among all scientific men. The perfunctory and mechanical teachers have largely disappeared, and happily the present generation of students are taught to observe, to investigate, to make careful inductions and to work in the true scientific spirit.

We are glad to meet you as you come to us from your laboratories and various fields of research, your faces aglow with the enthusiasm of investigators and discoverers, to whom nature has been compelled to yield up some of her choicest secrets. Your presence and companionship will stir us with a new passion for truth, and when you depart, we shall feel that the priests of science have dwelt under our rooftree and left a blessing on the gates of our dwelling.

SOME ASPECTS OF THE ENDOWMENT OF RESEARCH.[1]

In the days of ancient Rome the returning conqueror borne on his triumphal car must listen to a slave who bade him to remember some joy-dispelling facts.

After the lapse of many centuries the Naturalists, oddly enough, revived this pagan ceremony. By them each year a slave is chosen who, at the next season of

[1] Address at the meeting of the Society of American Naturalists at Ann Arbor, December 28, 1905, by Henry H. Donaldson, chairman of the Central Branch.

their triumph, is permitted to make a few remarks intended to hold down to earth those who are leading the procession.

It is a good custom, but wearing on the slave. One experience generally does for him. Yet, his privilege implies an obligation and in pursuance of this obligation, which our usage thus imposes, I have chosen for my theme 'Some Aspects of the Endowment of Research.'

The questions which this topic conjures into life have lately pressed themselves on my attention, and it appears that the only way to put them decently at rest is to sentence them to death—in an address—and then allow them to be buried—in the records of our learned society.

The events which have brought the endowment of research into special notice during the last decade are known to all. As examples of the thing I have in mind, let me cite the Carnegie Institution, the Rockefeller Institute and the Nobel prizes.

Such notable foundations have claimed our attention because they were recent, involved great sums of money and closely touched our interests as working naturalists.

But we should view them in their historical relation in order to appreciate their broader significance, and when this is done it will be plain, I think, that their novelty depends most largely on the fact that in a measure they can be devoted to the aid of biological investigation.

Even in our own young country such foundations are by no means new. Our academies and learned societies have long had funds for the encouragement of investigation. To be sure, these have been mainly applied to the domain of the physical sciences—a fact which needs no explanation when we recall that the physical sciences were the first to be pushed forward by the wave of modern interest.

Nevertheless, such foundations as the Smithsonian Institution and the Elizabeth Thompson Fund have for many years contributed to biological progress. Inadequate as these provisions are to meet what we may courteously call the reasonable wants of workers in this field, they serve to show that, here and there, an individual has recognized the need of larger resources for scientific work, and has sought to supply them. When we look across the water, we find provisions of this sort to be an old story to the older world.

Throughout Great Britain and the continent, academies and societies for generations have had at their disposal no inconsiderable sums of money—indeed, in many instances, far greater sums than we are wont to imagine.

The expenditure of these moneys has been mainly for work outside the natural sciences, but even within this latter group biological work has had the lesser share. This is said in no spirit of complaint, but merely to suggest why this condition of affairs in the scientific world at large is so rarely forced on our attention.

But there are still other ways in which the expenses of scientific work have been defrayed. States and nations, as well as individuals, have been contributors. The former have expended really great sums on the various branches of science in the conduct of surveys, commissions, bureaus, observatories and expeditions. The movement has been coextensive with the civilized world, and the outlay much greater than that for the corresponding scientific work in institutions of higher learning. On this topic it is not necessary to enlarge, but I will only add that the work accomplished has been enormous and without state aid would have been well-nigh impossible.

It is plain, however, that we should distinguish in a general way between governmental science work supported from the public funds and the other kinds, repre-

sented by university science and that which has developed under the special endowments for research, for the responsibilities of the investigation are often very different in the two cases. But these distinctions need not be elaborated, and are here noted merely for the sake of clearness later on.

My point is made, if by these remarks your attention is directed to the fact that the endowments, which to-day are to us best known, stand merely as the latest in a long list of gifts left with the hope of aiding the advance in knowledge, and if these bequests of the last few years are in any way peculiar, they are chiefly so by the reason of the generosity of the donors and the arrangement of the donations to include biology.

Yet, if we take the broadest view of the situation, as represented by the scientific returns, it appears that it is within the universities that the more advanced and fundamental scientific work has been accomplished.

It is possible that this last remark will not command unqualified assent; and yet when the smoke of argument has cleared away it will, I think, remain essentially unmodified. But in reaching your conclusions, I beg you to remember that in an address like this it is necessary to speak broadly and to trust that one will be generously understood.

To present rightly the reasons for university productiveness, it will be needful first to say a word concerning the normal progress of scientific interest and also to make a little more precise the idea of research.

As this company is well aware, interest in any scientific field passes through a regular series of progressive phases. Attention and effort are first concentrated on the collection and classification of the material. This constitutes what may be termed the systematic phase. But only after this portion of the task has been in some measure accomplished, can comparison and experimentation be undertaken as a basis for inductions which shall yield new knowledge and enlarge our philosophic view.

It is the sort of work that characterizes this second phase of our advancing interest which is best designated by the term research, and in this paper we use the word in such a sense.

It is contended then that the universities furnish the conditions in which research grows best—and if true, this fact is worthy of examination.

Broadly speaking, the effect of these favorable conditions is best seen in the mental attitude of the investigator towards his work. The men of the universities have been freer than any other group to follow the leadings of their own investigations, and to solve the next problem which logically confronted them, or, at least, to spend their time, mayhap their lives, and not infrequently their patrimony, in seeking a solution.

It is true, however, that such scientific freedom does not by any means always exist where work in science is in progress. Sometimes, in the case of the endowments intended for research, and much more often in the case of scientific work dependent upon the public funds, the expenditures have been applied for assigned work where the plan or program ran even into petty details; statements of progress or reports of activity being expected or demanded.

Unfortunately research can not be thus assigned, because there is nothing to assign. The investigator, like an adventurous explorer, thinks 'the country to the west looks interesting' and he makes a start. It may be years before we hear from him again, and no man can justly predict success or failure. We do not ask of such a man

that he should first draw a map of the unknown region, or engage to see that those who sent him are kept regularly informed. His energies and time belong to other work.

In many fields the hard, laborious initial work has been so largely done that the second phase of interest is the one before us and we must cast about for the best and surest way to meet the problems which are thus presented. If these have had their best solution thus far in the universities, let us look that way for our enlightenment.

It is safe to assume that this company knows the drawbacks—some of them at least—which inhere in university life, but with your consent that topic may be put aside. On the other hand, the advantages should be briefly stated. They are these—immediate association with productive colleagues; the vitalizing contact of the stream of youth; no responsibility save to the high court of one's fellow workers; no assignments or programs imposed from without, but full liberty to follow where the research leads—time not being 'of the essence of the contract.'

These are conditions which make for intellectual growth and accomplishment; these are the conditions which in the university surround the research worker, and these are the conditions which the effective endowment of research should struggle to preserve.

If such views are sound, then isolation—the kind that withdraws a worker from his colleagues and the stream of youth—is to be looked on with suspicion. There may be moments when the investigator, finding his days broken into little bits and his energies dissipated by irrelevant and trivial affairs, is fascinated by an opportunity which hints at isolation and promises relief, forgetting that, if to escape the ills he also sacrifices the advantages of his university surroundings, he has put himself in a position where few men hold their own. Lady Dilke describes it thus:

> The man who for any cause utterly forsakes the paths of his fellow-men is by them given up, as lost, and becomes as one of no account—being reckoned a dreamer of idle dreams.
>
> Therefore let him beware who hears that call—be it ever so alluring—which bids a man separate himself from his company, lest in the following after its strange music he should become a castaway.

But among the other features of the academic world which endowment should preserve, and perhaps the most important, is freedom from the limitations which naturally follow from assignment. The matter here is passing delicate.

It so happens that even investigators have failings—more or less human—and these must be considered. If it pleases us to imagine that our prototypes in the bygone days were the voyagers and adventurers of the Renaissance, let us take a sample of their point of view. Columbus, just anchored off the western isles, writes to his royal patron on the morning of that first Sunday that 'he and those with him have come thither to bring the light to them that sit in darkness and slake the thirst for gold which all men feel.' To-day we do not say it so naively, but yet we know how Columbus felt. It is this unfortunate combination of two powerful desires in the investigator's heart which causes trouble. How can such complex beings be made to bend all their energies to 'bringing light,' and at the same time be induced to properly neglect their 'thirst.' This is the problem which confronts those who are responsible for the wise management of research funds. There have been times when it was felt that assignments and limitations calling, as it were, for so much light per hour would accomplish the result. But any such device is contrary to the very spirit of research. What then, you ask?

Simply that when in the course of events an investigator is given great opportunities, it should be assumed that he is a heaven-born Lucifer, and will act accordingly. Should he prove unequal to the trust reposed, and his ways be ways of darkness—not of light—another must be entered in his place, but a truce to half-way measures. Research with a string to it suffers too many drawbacks.

Yet, even with freedom and right intellectual surroundings, we as investigators can hardly lay too much emphasis on the frame of mind in which we approach the problems that confront us. By our common methods, and even by our metaphors, we too often seem to advance upon the undiscovered country as though the chief desire were to reclaim it anyhow and any way, so that it were done rapidly and before others could arrive. This is a notion borrowed from the creed of economics, but it does not fit research. The endowment of research can foster more than this. Just as the frontier is not only the locality of active advance, but also the place where strong frontiersmen grow, so the chief gain coming from those stationed on the boundaries of science is not the mere reclamation of the wilderness, but far more, the improvement of the scientific breed, for as we advance the problems become rapidly more difficult, and it is only the abler men who can push on the work. For us then it becomes a privilege, if not a duty, to so work together that in this country the endowment of research shall be adjusted to preserve the intellectual stimulus and the scientific freedom which the universities afford, while it removes some of the drawbacks 'thereunto appertaining,' and so administered that in stimulating scientific activity, it shall do this not only and not mainly for the sake of immediate returns, but also, and even more, for the sake of the effect which the experience must have on those who do the work—aiming to develop the better man to meet the greater problem.

HENRY H. DONALDSON.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. SECTION E—GEOLOGY AND GEOGRAPHY.[1]

THE section was called to order by Professor Eugene A. Smith, retiring vice-president, who introduced and resigned the chair to his successor, Professor William North Rice. On motion Professor L. C. Glenn, of Vanderbilt University, was elected secretary *pro tem.* in the absence of the regular secretary of the section, E. O. Hovey. President C. R. Van Hise was elected a member of the council, Professor E. H. Barbour a member of the general committee and Professor L. C. Glenn press secretary. Fifty-nine members of the association were recommended for promotion to fellowship, forty of them on the basis of their membership in societies of high technical standing.

The address of the retiring Vice-president, Professor Eugene A. Smith, was on the subject 'On some Post-Eocene and Other Formations of the Gulf Region of the United States,' and will be printed in full in SCIENCE. Eleven other papers were upon the program, six of which were read in full by their authors. The other five were read in abstract or in full by the secretary *pro tem.* in the absence of their authors. Abstracts of all the papers read follow:

On the Use of the Words Synclinorium and Anticlinorium: WILLIAM NORTH RICE.

A technical term once introduced should be retained in the original sense. If in the progress of thought the concept which a word expresses ceases to be useful, the word may become obsolete, but should not be used to express a totally different idea.

[1] New Orleans meeting.

Secondly, a technical term should be etymologically appropriate.

The words *synclinorium* and *anticlinorium* were introduced by James D. Dana.[2] According to the form of the contraction theory of mountain-making developed by Dana, most monogenetic mountain ranges were believed to have been made by the crushing of the strata in a geosyncline. Such a range he proposed to call a *synclinorium*. The final part of the word is from ὄρος, mountain, and the word is altogether appropriate etymologically. Dana, however, recognized that a somewhat permanent line of elevation might be formed as a geanticline, a considerable area of the crust being elevated into a gentle arch without any considerable disturbance of the strata. Such a range he proposed to call an *anticlinorium*. As an example of an anticlinorium he cited the 'Cincinnati Uplift' formed in mid-Paleozoic time, nearly contemporaneously with the Taconic synclinorium.

The words synclinorium and anticlinorium are accordingly not stratigraphic, but orographic terms. They denote two types of mountain elevations.

I believe the anticlinorium type is more important than Dana himself supposed. The Appalachian range, for instance, was formed as a synclinorium in post-Carboniferous time, subsequently peneplained, and reelevated as an anticlinorium in Tertiary time. This remark is made in passing, as it is not my purpose at present to discuss the theory of mountain-making.

It is much to be regretted that several recent writers have used the words in entirely different senses. Van Hise unhappily set the example in his masterly—his really epoch-making—studies of rock deformation.[3] He uses the words in a purely stratigraphic sense, making an anticlinorium simply a compound anticline, and a synclinorium a compound syncline. He distinguishes synclinorium and anticlinorium from geosyncline and geanticline, using the latter pair of words substantially in the sense in which Dana used them. The etymology of the words synclinorium and anticlinorium is as inappropriate in the new sense as it was appropriate in the original sense.

Sir Archibald Geikie[4] and Scott[5] follow in the footsteps of Van Hise, distinguishing synclinorium and anticlinorium from geosyncline and geanticline, but using the former pair of words in the sense simply of compound folds. Geikie explicitly attributes to Dana the usage which he follows, but has apparently taken his definitions from Van Hise without referring to Dana's paper.

Chamberlin and Salisbury[6] have introduced a further confusion by treating synclinorium and anticlinorium as synonyms respectively of geosyncline and anticline.

It is, perhaps, too late to restore the words to their original sense, after they have been used in other senses by writers of so high authority. Yet such restoration seems very desirable.

The Overlap of the St. Stephens Limestone on the Lower Tertiary Formations in Crenshaw and Pike Counties, Ala.: EUGENE A. SMITH.

The paper described, with the aid of a map, a case of overlap of the Vicksburg limestone on the Nanafalia division of the lower Tertiary, where the former occurs in detached patches in the territory of the latter. The whole series of the intervening Tertiary formations outcrops between these

[2] *American Journal of Science*, Series 3, Vol. 5, pp. 431, 432.

[3] *Journal of Geology*, Vol. 4, p. 319.

[4] 'Text-book of Geology,' latest edition, pp. 678, 679.

[5] 'Introduction to Geology,' pp. 236–238.

[6] 'Geology,' Vol. 1, pp. 480, 481.

isolated patches and the regular outcrops of the Vicksburg.

On the Jackson Anticlinal in Clarke County, Ala.: EUGENE A. SMITH.

A well-defined anticlinal fold in Clarke County, Ala., shows some rather peculiar features of erosion and other phenomena which were described with the aid of an illustrative map.

Erosion at Ducktown, Tennessee: L. C. GLENN.

Ducktown is situated on an old peneplain now uplifted into a plateau and thoroughly dissected so that the actual surface consists of slopes many of which are steep. It is a region of deep surficial rock decay, of heavy annual rainfall and of thick forest-covering under natural conditions.

The roasting and smelting of copper ores in the recent past has entirely destroyed the vegetation and left the surface perfectly bare. Surface erosion is rapidly removing the soil covering. The slopes are already deeply scarred with gullies only a few years old which are still rapidly growing.

The waste from the steep slopes has buried the former surface along the streamlets between them and is rapidly building up waste planes, so that neither slope nor narrow flood-plain is of any value for agriculture or grazing. Reforestation will be a very slow and difficult process.

Floods on these small streams rise higher and more rapidly than formerly and subside more quickly. During dry seasons some springs that were formerly perennial go dry and others almost cease flowing.

The case has peculiar importance as an illustration of not only the possibilities but the certain results of deforestation by man in other parts of the southern Appalachians, and of the need of adoption by the general government of a policy of forest preservation in these mountains.

The Hydrology and Geology of the Gulf Embayment Area of West Tennessee, West Kentucky and Southern Illinois: L. C. GLENN.

Unconsolidated deposits of Cretaceous or later age consist from below upward of Coffee, Rotten Limestone, Ripley, Porter's Creek, La Grange, Lafayette, Loess, Loam and Alluvium formations, the last four being surficial, but giving character in much of the area to waters from springs and shallow wells. Structurally the rocks dip gently from the edge toward the center of the embayment area.

The Coffee, Ripley and La Grange are water bearing and form one or more available sources of potable deep water over practically the entire region. The La Grange covers the greatest area and is most important. Deep waters are gotten at depths varying according to local conditions from 150 to 700 or 800 feet, the majority ranging from 200 to 400 feet. The water flows out at the surface in many cases and rises nearly to the surface in many others. The quality of the deep water is generally good. If any mineral matter is present it is apt to be a small amount of iron carbonate. Calcium and magnesium carbonate and sulphate may be present in some cases, usually in small quantities.

Increasing attention is given by the inhabitants of the region to these deep waters, and wells are sunk not only for corporate and industrial supply but for many private families. The beneficial effect of the deep water on the health of the users is marked.

The Skull of Syndyoceras: ERWIN H. BARBOUR.

A new fossil mammal, allied to *Protoceras* of the Oligocene and to the modern antelope, was discovered by the Morrill Geological Expedition of the University of Nebraska during the past season in the

Loup Fork Tertiary of Sioux County, Neb. The skull of this genus, which has been named *Syndyoceras,* is characterized by two prominent frontal horns which curve inward and by two maxillary horns which rise from a common trunk and curve outward. The anterior horns divide the anterior nares into two parts, the posterior of which resembles a blow hole. The lower canines have become incisiform by migration, and likewise the first premolar has become distinctly caniniform.

The following abstracts were read by the secretary *pro tem.* in the absence of the authors of the papers:

The Keweenawan at Lake of the Woods in Minnesota: N. H. WINCHELL.

A visit in August, 1904, to the south shore of the Lake of the Woods, disclosed large areas of gabbro, apparently identical with that of the Keweenawan seen at Duluth and at other points in northern Minnesota.

An examination of specimens collected by J. E. Todd for the Minnesota Geological Survey, now in the museum of the University of Minnesota, warrants the assumption not only that this rock, under some shades of variation, occurs widely on the south shore of this lake, but also that it is associated with heavy basaltic rocks quite similar to the black basalts of the Lower Keweenawan, as well as with red granite.

This discovery, while correcting the prevalent idea of the 'Laurentian' age of the rocks of the south shore of Lake of the Woods, indicates that the strike of the Keweenawan from Duluth passes northwestwardly, and probably includes the outcrop of copper-bearing amygdaloid lately announced by the Canadian Geological Survey, occurring in the prairie at the north end of Lake Manitoba, where the strike of the formation is northwest and southeast.

Some Sink-hole Lakes of North Central Florida: E. H. SELLARDS.

The porous and very soluble limestone underlying the Florida peninsula has occasioned some unusual topographic features. Owing to the surface mantle of sand, the porous limestone and the general flatness of the country, a very small part only of the rainfall passes off as surface water, the greater part going at once into the ground. The dissolving effect of surface water is shown in the enlargement of stream basins through limestone. The solvent effect of underground water is indicated by numerous sink-holes throughout parts of the peninsula. By far the greater number of these sinks are small. Some, however, reach considerable size. All are more or less perfectly circular. In time the banks become less steep through decay of rocks, and the sink thereby enlarged. In limestone regions with little or no clay above, sinks often remain open at the bottom, thus forming natural underground entrances for such rivulets or streams as drain to them. In regions holding some clay the sinks are likely to become permanently clogged and fill with water, affording a starting point around the sides for the hardwood species of plants. Occasional sink-holes occur of such size as to be entitled to mention as small lakes. Illustration of this kind of lake is taken from a series of sinks on the proposed university grounds at Gainsville. The largest of these spreads over something more than an acre. The banks are thickly clothed with the hardwood, or 'hammock' types of vegetation, and while steep on one side are sloping on the other. The overflow in the rainy season is carried away by a small stream heading near the sink. The sink presents many of the features of a small lake, yet is not so old or so far developed that its sink-hole origin is not clearly evident. Small, circular, possibly solution, lake basins are ex-

ceedingly numerous in Florida. The 'sink-hole' origin is assumed, however, to apply to a very few only of these.

Old Age in Brachiopods: H. W. Shimer.

Brachiopod shells show old age along lines parallel to that exhibited by higher animals; when maturity is passed the tissues cease growing so rapidly and finally begin to shrink. As the mantle, the principal shell-secreting organ, shares in these states, it must express them in its growth. After a species has attained its fully mature size, which size varies in different individuals, the decreasing rate of growth is shown in the more or less sudden change in the angle of curvature from the beak to the front of the shell. This is followed in very old individuals by the development of a groove at the contact of the two valves, indicating that actual shrinkage of the mantle has occurred. Some of the other accompaniments of old age are the lamellose condition of the concentric growth lines, development of spines and nodes, and the thickening of the valves by internal addition, especially around the muscular impressions. Externally, old age characters appear first at the cardinal angles and advance progressively to the front of the shell.

Dipnoan Affinities of Arthrodires: C. R. Eastman.

By means of a new interpretation of the jaw parts of Arthrodires, which is here suggested, homologies are established between them and the corresponding elements of dipnoans. The arrangement of mylostomid dental plates is shown to be closely paralleled in early stages of *Neoceratodus,* and the functional lower jaw is similarly articulated with the head-shield. Intimate structural resemblances, not only as regards cranial characters, but throughout the entire organization, are brought out through comparison of Arthrodires with modern lung-fishes, and these are scarcely to be explained except on the theory of a common origin. All available evidence points to the correctness of Newberry's original interpretation of Arthrodires as armored dipnoans, a view which is not now commonly entertained. Their origin is traced through primitive ancestral ceratodonts to the elasmobranch stem, independently of crossopterygians.

The Great Catalogue of the Heber R. Bishop Collection of Jade: G. F. Kunz.

The magnificent collection of jade which was made and presented by Mr. Heber R. Bishop during his lifetime to the Metropolitan Museum of Art, in New York, has been installed in a room which Mr. Bishop himself designed and had decorated by the noted firm of Allard Frères, of Paris, to make it the finest example on this continent of the style of Louis XV. The collection is here placed in some fifteen elegant cases, of gilt, bronze and plate glass, all in Louis XV. style, which with the decorations of the room illustrate a permanence and richness of material never excelled even in the time of the artistic French monarch himself.

The catalogue which is the subject of this note is issued in two magnificent volumes, and is limited to an edition of one hundred copies, none of which goes to a private individual and none of which will be sold. These volumes (stately folios) are printed on the finest quality of linen paper, and weigh, respectively, 69 and 55 pounds, or 124 pounds together. They contain 570 pages (Vol. I., 277 pp., Vol. II., 293 pp.), measuring nineteen by twenty-five inches. There are 150 full-page illustrations, in the highest style of execution—water-color, etching and lithog-

raphy—and nearly three hundred pen-and-ink sketches in the text.

No expense or care was spared in the execution of the work; some thirty scientific men and art specialists, both in Europe and in America, were engaged to contribute their views upon various aspects of the whole subject; and the illustrations were prepared in the finest manner possible, Chinese and Japanese artists being employed to execute many of them, and color experts being freely consulted, under the supervision of Mr. Bishop himself. The catalogue has, moreover, a special value from the fact that all the scientific investigations described therein were made upon material taken from the specimens in the collection itself.

This whole work, from its inception by Mr. Bishop in 1886 to the final distribution of the volumes, has required about twenty years, and was entirely planned and thought out by him. It is a cause of much satisfaction that the enterprise has been so fully and successfully completed along the lines which he laid down; but it is also a source of profound regret that he could not himself have lived to witness its final accomplishment. The whole cost has been met by the liberality of Mr. Bishop's provision, carried out by the care and thoughtfulness of his executors.

Attendance at the meetings of the section was discouragingly small, there being but seven geologists present during the whole time of the association meeting, and two of these did not arrive until after the adjournment of the section.

The foregoing account of the meeting has been prepared from the full notes kept by the secretary *pro tem.*

EDMUND OTIS HOVEY,
Secretary.
AMERICAN MUSEUM OF NATURAL HISTORY.

MORPHOLOGY AND PHYLOGENY.[1]

WE are at the present time passing through a season of morphological thaw. The doctrine of definite and fixed morphological types has been somewhat slower than that of the fixity of species, in melting under the fierce light, which beats on all scientific generalizations; but its disappearance has not been less final or less complete. This breaking up of the ice of morphological formalism, which has so long needlessly restrained the course of morphological and phylogenetic research, is not altogether unattended with the dangers which accompany the opening of a new spring. On the part of some there is fear or even hope, that not only the ice, but the banks of the river as well, will be swept away by the raging flood. There is, however, no more need to dread the final result for phylogeny, than there was to fear the disappearance of the doctrine of fixity of species, half a century ago, as subversive to taxonomy. On the contrary, we may reasonably expect that, as in the case of the sister science, morphology and phylogeny will in the long run vastly benefit by getting rid of the constraint of mere formalism.

It is now more than a generation since any considerable number of biologists has believed that species were created once and for all, and unchangeable until they became extinct. At the present time this doctrine enjoys scarcely even a pagan persistence in some of our more belated schools of learning. Whatever may be our individual views in regard to the doctrine of descent or evolution, we are in general agreed that species are derived by modification and change from previous species and not by a special creative *fiat.* This conclusion, as Darwin pointed out many years ago, in his 'Origin of Species,' is at bottom a mor-

[1] Presidential address delivered before the Society for Plant Morphology, Ann Arbor, December 29, 1905.

phological one. Since the appearance of the 'Origin of Species,' we have had developed, particularly in the realm of plants, the conceptions of the special science of ecology or epharmony. The rapid growth of this science has led to the clear realization of how remarkably the external form of plants may be assimilated by similar modes of life. Later still is the appearance in a pronounced form of the doctrine of mutational or saltatory evolution of species. The establishment of these two new disciplines, both having firm scientific foundations, has tended to weaken the hold of morphology on the scientific mind. For if the form of plants may be instantly and profoundly modified by the still occult process of mutation, or more slowly but not less surely by the more obvious influence of external conditions, then it is not unnatural that less importance should be attached to form and structure, which are the subject matter of morphology. And yet the doctrine of descent, the great outstanding generalization of the biological sciences, which few of us probably expect to see overthrown, is bound up with the integrity of the science of morphology. The doctrine of descent or phylogeny depends for its validity on the correctness of the inference that marked similarities of structure indicate a more or less close degree of relationship. In the existing situation, the new studies of ecology and mutation, still in the first gloss of their novelty, tend to outshine the older yet not less firmly founded science of morphology, which through lapse of time has suffered as it were a certain degree of surface tarnish. Newer aspects of morphology are, however, coming to light at the present time, which promise to restore to the subject all its former brilliancy. It is my intention this morning to give some brief account of these new developments.

A prevailing principle in the past in morphology has been to trace back organs or tissue-systems to a similar mode of origin from the growing point or young organ and hence to infer their morphological equivalence. Thus, for example, the morphological essence of a sporangium has been thought to exist in the possibility of deriving its sporogenous tissue from a clearly defined and early developed primordium known as the archesporium. Similarly the morphological value of the central cylinder or fibrovascular system of the higher plants is thought by many morphologists to depend on its origin at the growing-point of the organ, root, stem or leaf, from that so-called primary meristem, known as the plerome. In the case of the sporangium, the illuminating researches of Professor Bower have made it clear that not only may spore-producing cells arise outside the so-called archesporium, as in *Equisetum,* but also sterile or asporogenous tissues may originate from mother cells apparently destined to form spores, as in *Tmesipteris* and *Isoetes.* In the case of the sporangium, it is accordingly clear that its fundamental characteristic is that it produces spores and not that its sporogenous tissue originates from an archesporium. There can be no doubt whatever that in the vascular plants a spore is to be regarded as morphologically a spore, whether its mother cell comes from the so-called archesporial complex or not. In the case of the central cylinder of stele, the clash of many minds has not yet resulted in a similar general clarity of reasoning If we, for example, choose the case of the central cylinder of the root in the Angiosperms, which the recent very exact researches of Schoute show to be derived definitely and entirely from the plerome strand of the growing-point, we have a result which is in so far satisfactory from the standpoint of the older morphology. If we, however, proceed to the consideration

of the mode of origin of the secondary roots from such a root, we find that they are formed in all their parts, entirely within the central cylinder or plerome strand of the mother root. We have thus the cortex and piliferous layers of the daughter root, which are properly the derivatives of the apical meristems known as the periblem and the dermatogen, and not of the plerome, originating in this case from the plerome or its equivalent. A logical fallacy thus arises, if we regard the morphological value of the tissue-systems of the root as determined from the meristems from which they take their origin. Further, if we take the case of the stem of the Pteridophyta, where alone among stem organs, the so-called apical meristems can in general be somewhat clearly distinguished, we reach equally illogical conclusions. Let us, for example, follow certain recent writers in regarding the whole complicated fibrovascular system of the rootstock of the common bracken fern, *Pteris aquilina,* together with its interposed ground tissue, as constituting a single hypothetical circular stele or central cylinder, because all these tissues are derived from the plerome strand of the growing end of the rhizome. If in all cases the plerome were as generously large as it is in *Pteris aquilina* and sufficiently broad to include the fibrovascular strands, together with their interposed fundamental tissue, we might successfully sustain the thesis that there is but one central cylinder and the plerome is its prophet. Unfortunately, however, in some cases the plerome proves to be a misfit and is smaller than the central cylinder, which it should entirely include. As a result in some of the true ferns, essential tissues of the fibrovascular bundles, such as the pericycle, the phloem and even part of the tracheary tissues are left in outer morphological darkness, because they do not originate from the plerome, but from the periblem. In a recently published work, Professor Campbell even states that in the mature stem of *Equisetum* only the pith is formed from the plerome, all of the fibrovascular tissues being left outside. He concludes that in *Equisetum* the fibrovascular bundles do not form a part of the central cylinder. This is surely Hamlet with Hamlet left out, and may perhaps stand as the *reductio ad absurdum* of growing-point morphology. If our not very remote posterity compare our speculations in regard to the morphological value of the growing point in plants, with those well-known discussions of medieval doctors as to the number of angels who might successfully stand on the point of a needle, our neglect of logic will probably not appear less absurd than their entire disregard of facts.

The two examples just discussed sufficiently illustrate the present condition of transition in morphology. Although the ancient doctrine of preformation has long been consigned to the limbo of oblivion, it has nevertheless a disguised survival in the hypothesis that the organs of tissue-systems of the higher plants can definitely be traced back to an origin from certain definite primordia. This hypothesis appears destined to become as obsolete in morphology as that of predestination is in theology. We have in fact arrived at that stage in morphological enlightenment where, with the complete abandonment of all obscurantism, we call a spade a spade, meaning by a spade that which performs or has performed the functions of a spade. Nothing appears clearer in the present stage of our knowledge than that with Professor Goebel we must regard the organ as the tool or apparatus of a function and the organism as a complex of apparatus combining a number of functions. Yet even if it be true that the organ is but the tool

or apparatus of the function, it by no means follows, as is too often assumed, that morphology disappears as such and becomes merged with physiology. The methods of nature are economical in the extreme, and when she needs a ploughshare, she fashions it from a no longer useful sword, or if a pruning hook be required, she straightway makes it from a spear, without in either case too carefully obliterating the signs of former use. By reason of this fact, with changing conditions, the apparatus of obsolete functions is not cast aside and replaced by other apparatus constructed anew to suit the new functional demand, but is merely modified more or less profoundly for the new duty. This makeshift character of organs is the solid basis of morphology. Morphology thus takes cognizance of the conservative tendencies which inhere in form and structure, and is clearly separated from physiology which deals with the actual functions alone and their apparatus.

Since the conservatism which inheres in the form and structure of plants is the peculiar province of plant morphology, it can not afford to neglect the earlier and extinct vegetation which once peopled the earth. Almost until the present moment botanical morphology has labored, however, under a peculiar disadvantage in this respect. In the case of fossil vertebrated animals, which may be appropriately compared with vascular plants, the processes of decay, which accompany fossilization, only serve to make the skeletal tissues, morphologically the most important, stand out the more clearly, so that they thrust themselves, as it were, on the gaze of the beholder and thus at once suggest comparison with the similar structures of animals still living. You are all aware of the extremely important advances made in the earliest third of the last century by the great French anatomist Cuvier in the study, particularly of the vertebrate skeleton. Since the publication of his 'Ossemens Fossiles' and his 'Regne Animal,' there has aways been on the part of the zoologists a sufficient attention to the morphological and phylogenetic significance of the hard parts of animals, which are fortunately not only morphologically constant, but also extraordinarily resistent to decay. In the case of plant fossils the conditions have unhappily not been so favorable. Although it has been realized, especially in recent years, that the adaptations to environment, which so quickly affect the outward form of plants, act with extreme slowness on their fibrovascular skeleton, comparatively little advantage to morphology has resulted. Vegetable fossils, during the process of fossilization, are more subject to the ravages of decay than are those of animals, and the decay is generally not of such a character as to set their skeletal and morphologically important parts in strong relief. Indeed it is very frequently these parts which suffer first, owing to the fact that they do not often contain the antiseptic substances which are generally present in the softer tissues. Thus, for example, if it were not for the remains of the leaves of dicotyledonous plants in the Cretaceous, we should have little evidence for the occurrence of the Angiosperms at so early a geological epoch. The only relics of dicotyledonous woods which have come down to us are those somewhat rare ones of the upper Cretaceous which have been carbonized by fire. Thus in the Raritan beds there are quantities of dicotyledonous charcoals, but no remains of wood in the lignitic or other ordinary conditions of fossilization. Even when plant remains do show the very significant hard tissues preserved, the microscope is generally necessary for their diagnosis. Plant fossils then, if we except fossil leaves, do not ordinarily pre-

sent the significant structures in such a form that he who collects may read. For this reason large quantities of valuable material have been in the past thrown aside by the paleontological collector as undiagnosable. The skill of the lapidary too has often to be brought into play, before it becomes possible to satisfactorily identify a vegetable fossil or detect its affinities. This state of affairs has brought it about, that no such important results flowed from the labors of the great French paleobotanist, Brongniart, as from those of his more fortunate zoological contemporary Cuvier. Indeed such anatomical observations as were made by Brongniart and his more immediate followers were so misleading that they resulted in the conclusion that secondary woody growth was a phanerogamic character and consequently the mistake was made of putting the calamites and sigillarians with the gymnosperms and not with their real affinities the horsetails and clubmosses. This error proved to be very tenacious of life and was only finally overthrown towards the end of the last century.

The cheapening and improvement of all kinds of apparatus, which is one of the most gratifying features of modern scientific progress, has made it possible in the last decade or two to satisfactorily begin the investigation of the past history of the higher plants. Out of this study of the structure of the more ancient vascular plants, especially when carried on by those adequately equipped for such a task, by the knowledge of the anatomical structure of allied plants still living, have emerged a number of important general morphological principles, which are destined to have an influence on the development of botanical morphology and phylogeny, not less important than the investigation of Cuvier, in the last century, on fossil animals, have had on zoology.

One of these important general principles, namely, the repetition of phylogeny in ontogeny is not confined to plants, but has had few exemplifications heretofore on account of the fact that our knowledge of the past history of the vegetable kingdom has been so woefully meager. Of this principle one example will suffice. The researches of the paleobotanists have made us acquainted with the structure of a paleozoic transitional group of gymnosperms, the Medullosæ. These had the numerous concentric stem-bundles of many existing ferns, but differed from these in the fact that their bundles had secondary growth. Their anatomical structure otherwise strongly suggests the cycads, and Potonie has expressed in fact the opinion that the existing cycads have come from this fossil stock. This view has recently received a remarkable confirmation by the discovery of the French anatomist Matte, that in certain instances in the seedling of the living cycadean genus *Zamia,* concentric bundles resembling those of the Medullosæ are present. Many other similar examples might be cited from recent literature.

Perhaps the most important and most novel general principle which has resulted from the comparative study of living and fossil vascular plants is the elucidation of the tendency of ancestral characteristics to persist strongly in the reproductive axis or flowering stem. For example, it has been pointed out by Graf zu Solms that the arrangement and course of the departing foliar traces in the cycads is not of the complex type found in the vegetative stem of the living genera of that group, but of the simple type occurring in the leafy stem of the ancient cycadoidean stock, the Bennettitales. Dr. Scott has added to this the important observation that in certain cases the structure of the bundles of the cycadean reproductive axis resem-

bles that found in the vegetative stems of some of the very ancient Cycadofilices. Similarly the present speaker has observed that the structure of the woody axis of the cone in living species of *Pinus* differs strikingly from that found in the vegetative stem, and strongly resembles that found in Cretaceous *Pityoxyla*. This important principle of the persistence of ancestral features in reproductive axes is particularly significant, because it offers an independent support for the time-honored practise of the systematic botanist, who attaches great importance to the floral structures and their arrangements, in tracing lines of affinity in the flowering plants.

Another important new phylogenetic principle, which has recently emerged, and which is likewise the special property of the botanical morphologist, is that ancestral characters are extremely likely to persist as structural features of the leaf. For example, the leaf-bundles of the cycadean gymnosperms are the exact counterpart of the stem-bundles of some of the extinct and probably ancestral Pteridospermæ. This principle might also be illustrated by many examples if time permitted.

We have thus three important phylogenetic laws resulting from our more complete knowledge of the older vegetation of the earth. These principles or laws having been elucidated by the comparison of living with fossil forms may now fruitfully be extended as general working rules to the comparison of living groups with one another. The importance of these principles can scarcely be overestimated; for they enable us at once to put the sporophytic generation in the foreground as the basis of phylogenetic study. This is particularly fortunate, because it is precisely the sporophyte which allows fruitful comparison with extinct forms, since the gametophyte does not ordinarily become fossilized. Moreover, since the time of Hofmeister, the gametophytic generation has performed such an important rôle in morphological investigations that in recent years, in spite of the important discoveries of chalazogamy, the antherozoids of the cycads and Ginkgo, and double fertilization in the angiosperms, it has begun to show signs of exhaustion. The next half century, without neglecting the gametophyte or the earlier stages of the sporophyte, will doubtless give a great deal more attention to the later development and mature structure of the sporophyte, which being the predominating and unreduced generation, in the vascular plants, will yield, as our knowledge of the ancient forms becomes more complete, the most important morphological and phylogenetic results.

A further fruitful field for morphological exploitation is that of experimental morphology. This field, although much discussed and canvassed at the present moment, is as yet practically untouched from the phylogenetic side. It is difficult to see how it can be successfully cultivated by those who have not a reasonably complete knowledge of what may be called the normal anatomy of living and fossil plants. We appear as yet to be no nearer to the possibility of experimentally originating new species. Indeed, if we ever succeed in penetrating the veil with which nature conceals this part of her workings, the hypothesis that acquired characters can not be transmitted will have to be given up. For if by experiment we are able to bring it about that species acquire and transmit new characters and thus become new species, the doctrine of the non-transmission of acquired characters will become *ipso facto* obsolete.

In conclusion, it may be said that there appears to be no immediate prospect that the practise of making genealogical or phylogenetic trees will have to be abandoned. In constructing these trees, however, we

shall do well to avoid inferences as to relationship based on a single character. Phylogenies of the angiosperms based on the structure of the root-tip, or of the conifers on the supposed occurrence of a ligule in the Araucarineæ, or of the Pteridophyta derived from the presence or absence of a suspensor in the embryo or a basal cell in the archegonium, have in the past been far too common. We morphologists have sinned the sins of youth in this respect and have often provoked the just censure of the taxonomists. We must avoid, too, the using, for phylogenetic purposes, of characters which can be easily modified by environment, in other words characters which are formal or physiological. In making our phylogenetic trees, as Professor Coulter has recently happily expressed it, we have begun with the topmost branches and then have followed downward into the trunk. May we successfully continue this downward progress, so that in the fullness of time our perfect tree may stand firmly rooted in the earth, drawing strength and nourishment from every stratum which contains a vestige of the former vegetation of the world.

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THE AFFILIATION OF PSYCHOLOGY WITH PHILOSOPHY AND WITH THE NATURAL SCIENCES.[1]

I AM embarrassed that this discussion of the relations between philosophy and psychology immediately follows the exercises which have so emphatically and reiteratedly pronounced them one. I had written my brief paper purposely in a slightly more partisan than judicial spirit because asked to represent one side, and informed that others would represent the other. I had no idea, however, that I must read just at a moment which makes me seem to be trying to put asunder what Harvard has just now joined together. Objections to marriages are usually called for before the ceremony itself, and I almost feel that the proprieties of the hour should make me hold my peace here, though not forever afterwards. I feel like a divorce lawyer, thrusting his professional card into the hands of a wedded pair before they have left the church. However, the hospitality of our hosts will be, I am sure, more than adequate, and of course there was no thought of projecting the momentum of this occasion into the discussion to place my side of it at a disadvantage. At least, I will assume that the program takes precedence over any such proprieties and proceed with what I have written, which is as follows:

To me it seems only a truism to say that we do not and, perhaps, never can know any more of the ultimate nature, origin and destiny of the soul than we can and do of the nature, origin or destiny of matter or of life. In this sense psychology may do very well for the present without a soul as physics may do without an ultimate definition of force, or biology without a theory of life. This, moreover, is a positive and gnostic and not an agnostic standpoint except to those who place metaphysics, meta-biology or meta-psychology above these sciences themselves. *Definitions* of our science and even of each sense of will, cognition, feeling and the rest, may, perhaps, be divided into the following

[1] This was the topic on the program of the joint meeting of the Philosophical and Psychological Associations at Harvard, December 27, 1905. The introductory exercises of this session consisted in dedicating the new Emerson Hall with addresses by President Eliot, Dr. Emerson and Professor Münsterberg. The last named opened the discussion of the above question by arguing that philosophy and psychology, now under one roof, should be one and inseparable. The address here printed follows exactly as it was given except that part of the first paragraph was spoken in the discussion at the end.

kinds: (*a*) generalizations from facts which have at best only a classificatory and at worst a repeative, attenuated, verbal sense, from which the red blood of meaning has begun to evaporate; (*b*) attempts at logical interpretation or statements of genus and difference, with the corpses of which the pathway of our science is so thickly strewn and which are usually haunted with all kinds of personal and philosophic biases in which no two agree; (*c*) those prompted by man's inveterate longing for finality, which have a certain sacrosanct character because they are *so* satisfying to the author and which, therefore, constitute precious psychological data to be collected and used empirically for future generalizations concerning human nature. Of the soul and each of its powers it can be said, as Schleicher said of language, all discussion of the origin and definition of which was long forbidden by the Société de Linguistique, 'Es ist was es wird.' Thus every new fact in psychology changes the definition of it and, perhaps, makes some older ones obsolete, because the definition of the science is nothing more nor less than the science itself in its present state. Only the tyro in any subject seeks to begin with definitions, while the connoisseur only ends with them if he reaches them at all. But (*d*) there may be definitions made only for the purposes of speculation or of controversy. These should be expressly provisional and ought to be transcended at the end of every discussion. My definition of psychology is expressly of the latter kind and is as follows: It is a description as accurate as can be of all those facts of psychic life, conscious and unconscious, animal and human, normal and morbid, embryonic and mature, which are demonstrable and certain to be accepted by every intelligent unbiased mind who fully knows them. They must also be so ordered, like to like, and organized that they can all be known with the least effort, and so that each is nearest to that it is most akin. To this I would add that the best principle or organization of these facts, wherever it is justifiable, is evolutionary because the best explanation and definition of *anything* is a complete description of its developmental stages. From this definition you can foresee about all I have to say upon this topic.

Psychology deals with the facts, measurable and immeasurable, of sense and the inner life under conditions controlled in the laboratory, with statistics based on large numbers, with the myth, custom, belief and language of races, and is excluded from no field of experience, inner or outer, or of life, conscious or unconscious, religious, social, genetic, individual, that can be studied on the basis of valid empirical data. The individual speculator or system-builder who goes beyond these facts contributes nothing save one more personal set of data for the future generalizer. Consciousness, too, is an island in the midst of the shoreless, unconscious sea, or, better, in Huxley's simile it is a tallow dip illuminating only one room of the great museum of man-soul. Consciousness can only give us a glimpse of the experience of the individual and hardly that of the race. From this it follows that psychology must more and more rest upon induction and that its closest allies in the future are to be biology, physiology and anthropology.

What should it exclude? My answer is that it is just as proper, and no more so, for it to concern itself with the relations between mind and body as for physics to speculate about the relations between force and matter. It is no more pertinent for it to discuss parallelism or interaction than it is for abnormal, genetic or comparative psychology to do so. It makes no possible difference for any scientific fact of psychology whether the soul is a spirit, a mesh of neurons or a monad in Howison's sense.

These are meta-psychological considerations which we can neither prove nor disprove; they are matters of taste in philosophy, of individual bias, popular oracles to which those of literary proclivities or those who love the ancient developmental history of psychology can appeal. They are matters of creed, and often with some, and it may be great, practical value. The same is true of the old issue between dualism and monism, of freedom *versus* determinism, the nature of time, and still more so of space. These old problems in all their restatements, including that of the priority of psychic or somatic changes in feeling, the question of the educability of the pure absolute quality of retentiveness, have high pedagogic value and have impelled many ingenuous minds to the study of psychology, and their motivation is hard to exorcise in the present state of psychology, even from the stage of scientific maturity. As old sailing ships were trimmed by rolling heavy ballast chests full of old chains to starboard or larboard, according as the ship listed this way or that, so the ship of life sometimes needs to be ethically trimmed by changing the stress of these old and broken fetters of the soul; but not till the far-off day when pragmatism has quite absorbed and digested the concept of pure science should these be confused with the precious cargo of facts.

So of all attempts to define knowledge and its relations to reality, to deliminate subject and object and to decant the universe from one into the other, or to determine how many parts of each are found in the mixture of experience, whether the ego is constituted of flitting, disconnected present states or is the stream bed in which they flow, or whether, on the other hand, every change of attention is an expression of the basal and eternal will to live. If *homo studiosus* were less isolated from the daily struggle for existence, suffered less from psychic anemia, if, instead of being pampered with a second-hand, attenuated book knowledge, he had had in his own person more of the experience he attempts to analyze, and if his selfish interest in a future life were entirely eliminated, all those questions would fade into dreams and shadows. Neither the abnormal nor the selfish impulses which animate these impulsions are scientific, and therefore these questions should be segregated from psychology, for which they have no more pertinence than they have for chemistry or astrophysics.

Again, psychology inherits from philosophy a passion to classify the soul into activities, parts, faculties; to attempt to organize the different sciences; to legislate what should be done in each field and under each name; to demarcate boundaries between esthetics, ethics, logics, psychology and the rest. The age when this work can do much good or harm ended with Hegel and Comte, unless it have some value for the pedagogy of curricula or be of use to the maker of the scheme in putting his own mind in order. Logic never led to the discovery of anything, not even of a new method of investigation. At best it follows the discoverer, often at a distance, and may at best afterwards tell how his work was done. Psychology seeks its own in any and every field where psychic action is intense and manifold. But all schematizations of the relation of different fields are only tenuous formulations of the personal equation, and if they could be valid for a day are sure to be shattered by the next fruitful research. More than this, too long acquaintance with the breezy altitudes of philosophy at the same time predisposes and disqualifies for this task because it tends to a nimbleness impossible for a mind which carries a heavy cargo of facts. Intellectual temperance is not its forte. In the day of Borelli, and again with Fechner

and Herbart, and now with Karl Pearson, men of our craft have lost poise and become mathematical methodists, forgetting Aristotle's injunction to the effect that it is the mark of an amateur to insist on a greater degree of accuracy than the subject permits. So years ago when a man of science said that memory was a continuity of vibrations and that heredity and even the properties of matter were a form of memory, this speculation found place in many a text-book almost as if it were a new category, and here it stood as if consubstantial with the basal facts which all admit. When hypnotism showed the importance of suggestion, it was interpreted by some of the very ablest philosophic minds as including about every form of mental action, and originality and spontaneity themselves were eclipsed by it, while others argued that even heredity was a form of suggestion. In a similar holophrastic way, irritability, reflex action, electrical stimulation, tremors and vibrations, the atom concept in the form of reals and monads, the ego, the feeling of absolute dependence, the emotions, the intellect, the will, memory, and many more, have been overworked or made the key for an entire system. This constitutes at once the charm and the confusion of the history of philosophy. It infects the mind with the idea that a new principle can be found to explain, or an old one stretched to include, or be made the key to unlock, the entire universe; that the secrets of mind are to be taken by storm and perhaps by brilliant individual soldiership instead of step by step by a long siege. This is the very opposite of the Aristotelian temperance with its motto—'Nothing too much.' It is this that has caused psychology, especially in America to-day, to be shot through with surds, with metaphysical problems injected up from ancient fires like dikes, here an established conclusion from the laboratory or a fact from field work, in the next paragraph a discussion of its bearings upon some venerable philosophical problem.

In all this I mean no disrespect to philosophy, the history of which I have always taught and tried to understand and held worthy of highest honor as the culmination of culture history. Are we not all a little in the unhappy state of an importunate lover of two mistresses who either finds it hard to choose between them, and therefore may die without issue, or seeks to wed the preferred one without relinquishing his hold upon the other?

Again, psychiatry is just now coming our way. Its extreme subserviency to neurology is abating. Wernicke and the somatologists whose chief paradigm was general paresis, the outcome of which was sure death and which showed brain lesions, is giving way to Ziehen, Janet and Hughlings Jackson, whose type diseases are epilepsy, hysteria, etc., and who proceed from function to structure and not conversely. This opens up an unprecedented opportunity for normal psychology to influence psychiatry. But, alas, owing to the infections of our field by metaphysics, we are not unified enough to profit by this opportunity. This is a large and vital chapter I can only allude to here.

Finally, should not psychology now practically accept the more modest ideal of Bateson in biology and for a time be content to find and describe facts so as to broaden the base of the pyramid, refuse to accept its problems from speculative or even ethical philosophy, suspend judgment and even refrain from indulging the literary passion, if we have it, by writing attractively concerning insoluble questions? Thus, while keeping open the perspective by teaching the history of philosophy to every experimenter, must we not admit that we are all materialists and idealists, realists and phenomenalists, necessitarians

and freedomists, pantheists and atheists, scholastics and empiricists at the same time, and that to affirm the one exclusively is to expel a minority of faculties of the infinitely complex thing we call soul, and that one who truly knows himself can be any one of these only by a working majority of his powers? Accepting our cue from Aristotle, who called metaphysics those studies that come chronologically or developmentally after physics, and applying them also to all logic and epistemology, should we not recognize that the present glowing twilight of psychology is that of the dawn and not of the evening; that ultimates are chiefly for senescence and should be only prelusive for youth; that they better befit old than new sciences; and realize that if psychology is ever to become the queen of humanistic studies she must avoid all surds and extravasations and deal effectively with the great problems of human life, health, reproduction, disease and vital experience, and find the center of her field where psychic life is most intense, and thus, widening her boundaries from physiological psychology to biological philosophy, strive to become what, as we have just heard in the able address of his son, Emerson, for whom this admirable building was named, thought it should be, viz., a true natural history of the soul. Some of us deprecate this identification or organic unity of speculative philosophy with scientific psychology, and hope that, despite their proximity, neither will interfere with the purity of the other, and that progress may be made in evicting the many metaphysical, logical and epistemological and other utterly insoluble, though fascinating, questions from the domain of scientific psychology.

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SCIENTIFIC BOOKS.

Organography of Plants, especially of the Archegoniatae and Spermophyta. By Dr. K. GOEBEL, Professor in the University of Munich. Authorized English translation by ISAAC BAYLEY BALFOUR, M.A., M.D., F.R.S., King's Botanist in Scotland, Professor of Botany in the University and Regius Keeper of the Royal Botanic Garden of Edinburgh. Part II., Special Organography, with 417 wood cuts. Oxford, the Clarendon Press. 1905. Pp. xxiv + 707. Large 8vo.

It is five years since the English edition of Part I. appeared. That volume was devoted to 'General Organography,' including the general differentiation of the plant-body, relationships of symmetry, differences in the formation of organs at different developmental stages, juvenile forms, malformations and their significance in organography, and the influence of correlation and external formative stimuli upon the configuration of plants. It has proved its value by its wide use in advanced botanical teaching in this country and England. Part II. has now appeared as a bulky volume and, although the German edition from which this was translated was completed in 1901, the preface informs us that 'Professor Goebel has read all the proof-sheets, and has modified the text in several places, and added additional notes.' The volume is thus brought down to the present, and consequently is the most recent work on plant morphology, as it is the most important. The subject is taken up systematically, about one hundred and fifty pages being given to the liverworts and mosses, fifty pages to the gametophyte of the Pteridophyta, and over four hundred to the sporophyte of the Pteridophyta and Spermophyta. It is under the latter that we find the fullest discussion of the morphology of the higher plants, the matter being treated under such topics as—the organs of vegetation, including root and shoot (leaf, branching of the shoot, division of labor, the shoot in the service of reproduction), and the organs of propagation, including the sporogonium of Pteridophyta apospory, and the sporangium of Spermophyta.

It is interesting to note here the greatly broadened use of terms, which an older morphology concerned itself with narrowing. What would the botanists of the last genera-

tion have thought of the common use of 'spore' and 'sporangium' in the description of the structure of the flowering plants, and how they would have denounced the use of 'flower' and 'placenta' in the similar description of the ferns and their allies! Surely the old boundaries between lower and higher plants are rapidly being obliterated when we find such a free borrowing of terms once thought to be peculiar to this or that portion of the vegetable kingdom. Here is the present-day definition of a flower—'a shoot beset with sporophylls,' originated many years ago by Schleiden, but generally rejected by botanists until within a comparatively short time. In this broad definition we may include the spore-bearing cones, not only of *Lycopodinae* and *Equisetinae,* but also the whole fern (sporophyte) when it is bearing spores. On page 472 we have a chapter heading 'The Sporophylls and Flower of the Pteridophyta'—which would have puzzled and no doubt shocked the old-time botanists, and quite as puzzling would have been the section (page 400) devoted to 'the cotyledons of the Pteridophyta.'

In this fine volume, which must at once come into very general use, we have another illustration of the excellent translations made by Professor Balfour, and the high quality of the printing and binding done by the Clarendon Press, in the remarkable series of volumes which have appeared during the past twenty years.

Charles E. Bessey.

The University of Nebraska.

Outlines of Inorganic Chemistry. By Frank Austin Gooch, Professor of Chemistry in Yale University, and Claude Frederic Walker, Teacher of Chemistry in the High School of Commerce of New York City. New York, The Macmillan Co. Pp. xxiv + 233 + 514. 8vo. $1.75.

Until some few years ago the teacher of general chemistry considered that he had covered his subject pretty fully if, in addition to the descriptive facts concerning the elements and compounds, he had given his students correct ideas concerning the laws of chemical combination, molecular and atomic weights, the periodic law and the theory of valence. The development of physical chemistry, however, in the last fifteen years has brought into prominence a number of new laws and principles and it is necessary that these should find a place in every modern course of instruction in chemistry. This has given rise to a demand for new text-books in which these new generalizations are clearly set forth.

One of the first text-books which gave prominence to the laws of physical chemistry was Ostwald's 'Grundlinien der Anorganischen Chemie' which was published in 1900. This book may be said to have been a veritable mine of information for teachers and it has undoubtedly had a great influence in modernizing courses of instruction in inorganic chemistry. Ostwald's book, however, is too advanced and contains too much detail for the average undergraduate. A number of smaller text-books have appeared in which the attempt was made to simplify the subject and adapt it for college classes.

This new text-book by Professors Gooch and Walker is entirely different from these books that were patterned more or less closely upon the lines of the Ostwald. It is divided into two distinct parts. In the first or inductive part there is a consecutive experimental development of the principles and theories of the science. In the second or descriptive part the facts concerning the elements and compounds are clearly and concisely set forth.

The first seven chapters of part one deal with chemical change, elements, compounds, the laws of combination and equivalent weights, hydrogen, oxygen, air and nitrogen. Then electrical equivalents and ions, acids, bases and salts form the subject matter of the eighth and ninth chapters. Then follow equilibrium, mass action, the phase rule. The last chapters are upon heat and thermal equivalents, valence and atomic and molecular theories. It is here shown that the chemical, electrical and thermal equivalents represent proportionate numbers of mass units or atoms and atomic and molecular weights are defined.

In the second or descriptive part, after a chapter on classification and the periodic law,

the elements are taken up in series beginning with hydrogen. Under each element all the more important facts concerning it and its compounds find mention. A great many graphic formulas and equations are here given. The rare elements are also briefly noticed. A very large amount of information together with the latest and newest facts is here brought into small compass. The statements are clear and concise and the book is remarkably free from errors. There are few important omissions. The transition point of mercuric iodide is given, but not that of sulphur nor that of tin. Freezing mixtures are mentioned, but no explanation is given of their action. On the whole, however, this is an excellent text-book, it is planned on new and original lines and it deserves the careful consideration of all teachers of chemistry.

EDWARD H. KEISER.

SCIENTIFIC JOURNALS AND ARTICLES.

The Bulletin of the College of Charleston Museum for January contains the report of the director, Dr. Paul M. Rea, and is an encouraging account of progress, though under difficulties. The museum has important collections and, as Dr. Rea points out, with the funds and assistance necessary to put these in order and make them available to the public, will become an important educational factor.

Bird Lore for January-February has for its most extended article the Sixth Christmas Bird Census, containing records from Maine to Louisiana and British Columbia. There are good illustrated articles on 'An Experience in Tree-top Photography,' by Bert F. Case; 'My Chickadee Family,' by Marion Bole; 'The Dipper in Colorado,' by Evan Lewis, and 'The Little Green Heron,' by Rett E. Olmstead. In the report of the Audubon Societies it is noted that the murderer of Game Warden Bradley was not even indicted. As an offset to this are the resolutions passed by the Millinery Jobbers Association at the Louisville Convention, pledging themselves not to buy song birds, gulls, grebes or herons after January 1, and not to sell after July 1, 1906.

The Zoological Society Bulletin for January contains a well-illustrated article on the 'Pheasant Aviary and its Inmates' which comprise forty species of gallinaceous birds. The 'Founding of a New Bison Herd in the Wichita Forest Reserve' is announced and it is hoped this may lead to the starting of herds in other localities while the bison are yet available. It is stated that the female giraffe received in 1903 has grown one foot and eleven inches and the male two feet and ten inches, the one standing twelve feet high, the other thirteen feet and six inches. Barring accidents, they should before long reach their full height of between sixteen and seventeen feet. There is an article with several good pictures of the smaller cats and, finally, a summary of the larger items of work accomplished during 1905.

SOCIETIES AND ACADEMIES.

AMERICAN PHYSICAL SOCIETY.

THE annual meeting of the Physical Society was held in Fayerweather Hall, Columbia University, New York City, on Friday, December 29, and Saturday, December 30, 1905.

The presidential address of President Barus, on 'Condensation Nuclei,' was delivered on Saturday, December 30, at 11 A.M.

Friday afternoon, December 29, a joint session of the American Physical Society and the American Mathematical Society was held in Havemeyer Hall, at which a paper on the 'Experimental Demonstration of Hydrodynamic Action at a Distance' was presented by Victor Bjerknes.

The following papers were presented:

A. W. EWELL: 'The Electrical Production of Ozone.'

E. RUTHERFORD: 'Some Properties of the Alpha Rays from Radium, II.'

E. RUTHERFORD: 'On the Magnetic and Electric Deviation of the Alpha Rays.'

E. P. ADAMS: 'The Absorption of Alpha Rays in Gases and Vapors.'

H. A. BUMSTEAD: 'The Heating Effect produced by Röntgen Rays in Different Metals and

their Relation to the Question of Changes in the Atom.'

W. J. Humphreys: 'An Attempt to Explain the Cause of the Pressure Shift and the Broadening of Spectrum Lines.'

E. H. Hall: 'Thermoelectric Heterogeneity in Certain Alloys.'

F. L. Tufts: 'The Relative Conductivities imparted to a Flame of Illuminating Gas by the Vapors of the Salts of the Alkali Metals.'

C. B. Thwing: 'On the Specific Electrical Potentials of Metals in a Chemically Inert Atmosphere.'

H. A. Clark: 'The Optical Properties of Carbon.'

H. L. Blackwell: 'Dispersion in Electric Double Refraction.'

Wm. B. Cartmel: 'The Optical Properties of Extremely Thin Films.'

Edgar Buckingham: 'The Thermodynamic Temperature Scale.'

C. H. McLeod and H. T. Barnes: 'Differential Temperature Records in Meteorological Work.'

S. R. Cook: 'On the Velocity of Sound in Gases at Low Temperatures and the Ratio of the Specific Heats.'

K. E. Guthe: 'A New Determination of the E.M.F. of the Clark and Cadmium Standard Cells by means of an Absolute Electro-dynamometer.'

G. W. Pierce: 'Experiments on Resonance in Wireless Telegraph Circuits.'

Edgar Buckingham: 'Methods of Soil Hygrometry.'

H. N. Davis: 'Longitudinal Vibrations Analogous to those of a Violin String.'

A. D. Cole: 'On the Use of the Wehmet Interrupter with the Righi Exciter for Electric Waves.' (Read by title.)

E. F. Nichols: 'Notes on the Possible Separation of Electric Charges by Centrifugal Accelerations.' (Read by title.)

Frank Wenner: 'The Adjustment of the d'Arsonval Galvanometer for Ballistic Work.'

W. J. Humphreys: 'The Purpose and the Present Condition of the Mount Weather Research Observatory.'

Lyman J. Briggs: 'An Electrically Controlled Thermostat operable at Room Temperatures.'

Lyman J. Briggs: 'On the Use of Centrifugal Force in Soil Investigations.'

On Saturday morning, tellers being duly appointed, the ballots received in the annual election of officers and members of the council were counted, and the following named were declared elected: *President,* Carl Barus; *vice-president,* Edward L. Nichols; *secretary,* Ernest Merritt; *treasurer,* William Hallock; *members of the council,* R. A. Millikan and A. Trowbridge.

Ernest Merritt,
Secretary.

THE TEXAS ACADEMY OF SCIENCE.

At the formal meeting of the Texas Academy of Science held June 14, 1905, the election of the following officers for the year 1905–6 was announced:

President—Dr. Thos. H. Montgomery, Jr., Austin.

Vice-president—Dr. James E. Thompson, Galveston.

Treasurer—Mr. R. A. Thompson, Austin.

Secretary—Dr. Frederic W. Simonds, Austin.

Librarian—Mr. P. L. Windsor, Austin.

Members of the Council—Hon. A. Lefevre, Victoria; Professor J. C. Nagle, College Station; Dr. Eugene P. Schoch, Austin.

At the regular meeting of the academy held in the chemical lecture room of the University of Texas, October 27, 1905, Dr. Montgomery delivered the annual address of the president. He chose for his subject 'The Esthetic Element in Scientific Thought.'

The point was made that the key-note of the enthusiasm of the scientist, therefore of his wish to work, is the attraction he finds in the formal beauty of the objects of study. This generally arises in early years, and probably continues as long as his enthusiasm lasts, though in maturer years the scientist finds a greater beauty in the interpretation and relations of phenomena. The scientist is distinguished by this love of the formally beautiful, the well-spring of his enthusiasm, and thereby shows a close community with the artist and poet. On the other hand, there is nothing in common between the scientist and the technical expert, for they have entirely different aims; the scientist is to be trained like an artist, not like a technician. From this love of the natural phenomenon arises a reverence for nature, which brings it about that no true scientist can be without a religion. The great naturalists and great poets have all recognized this kinship.

At the regular meeting held in the chemical lecture room of the university, November 24, 1905, Dr. Lindley M. Keasbey addressed the academy upon 'The Science of Economics.' The following brief abstract will show the scope of his remarks:

In the last instance, economics is an elaboration of the weal relation, which is as follows: Demand tends towards utility, utility necessitates utilization, and utilization results in supply. Consequently the science consists of three parts: Economic psychology, economic geography and demography, and economic history.

1. *Economic Psychology.*—Demand tends toward utility because all men seek to satisfy their wants and utility is the quality of satisfying such wants. The first term of weal relation therefore requires an analysis of human wants, resulting in a hedonic classification and a hedonic calculus.

2. *Economic Geography and Demography.*—The qualities of satisfying wants are circumstances of persons and things, hence potential utilities may be said to reside in man's physical and social environments. The study of these environments with a view to determining their potential utilities constitutes the second part of the science: economic geography and demography.

3. *Economic History.*—In striving to satisfy his wants, man is compelled to convert potential utilities into actual utilities. The study of this process of utilization constitutes economic history, the third part of economics, the dynamics of the science, as it were. In short the subject-matter of economic science may be said to be: The system of activities whereby the potential utilities pertaining to persons and things are through utilization converted into actual utilities.

On the evening of December 28 and the morning of December 29 joint meetings of the Texas Academy of Science and the Scientific Society of San Antonio were held in the rooms of the latter organization in the Stevens Building, San Antonio. The program for the evening session included a lecture upon 'Iron-smelting and Steel-making,' illustrated with many steriopticon views, by Mr. Edward C. H. Bantel, of the engineering department of the University of Texas. The speaker's familiarity with the subject from residence and study in the center of the Pennsylvania steel district enabled him to handle it in a most interesting and detailed manner. Mr. Bantel was followed by Captain T. J. Dickson, U.S.A., Chaplain of the Twenty-sixth Infantry, Fort Sam Houston, San Antonio, who presented two papers: 'Fighting Asiatic Cholera' and the 'First Ascent of Mount Isarog,' both of which were illustrated with stereopticon views.

Mount Isarog is a famous volcano in southern Luzon. The speaker, with eight soldiers and five Filipino cargadores, made the first and only ascent in June, 1903. The summit is a sharp, jagged contour, about two miles in diameter. The trees are knotted and dwarfed and evidence the mighty battle they have waged while contending with the storms that raged around the summit. It has the appearance of a deep soup bowl with one side chopped out. It was possible for members of the party to climb out on the limbs of trees and look down a distance that was estimated one mile.

The last number on the program of the evening session was 'Facts furnished by the Study of Radium and Deduction leading to the Present Electron Theory,' by Dr. Eugene P. Schoch, of the school of chemistry, University of Texas. This exercise, which was a demonstration rather than a lecture, attracted much attention, as outside of the university nothing like it had ever before been seen in Texas. In the audience were a number of officers of the regular army stationed at Fort Sam Houston. It is a pleasure to note the interest these gentlemen have taken in science and the promotion of the scientific spirit within the state.

At the morning session, on December 29, Dr. W. L. Bringhurst, of San Antonio, read a paper upon 'Some Recent Experiments in Biology,' dealing chiefly with the results of the interbreeding of different varieties of the domestic fowl.

FREDERIC W. SIMONDS,
Secretary.

THE GEOLOGICAL SOCIETY OF WASHINGTON.

AT the 174th meeting, on January 24, under the head of 'Informal Communications,' Dr. David T. Day bespoke the cooperation of the geologists of the society in furthering the investigation of black sands, and especially of heavy material derived from sluice boxes by

placer miners. In collecting samples it is especially necessary that the amount of gravel represented by the concentrates should be noted.

The following papers were then presented:

Geological Reconnoissance Map of Alaska: Mr. Alfred H. Brooks.

Gypsum Beds and Water Storage in the Pecos Valley of New Mexico: Mr. Willis T. Lee.

An irrigation system has been in operation for eleven years in the Pecos Valley near Carlsbad, N. M. The storage reservoir of the system at McMillan began to lose water by underground leakage soon after its completion, and this loss became progressively more serious until at the present time the reservoir is almost useless. This paper deals with the geological conditions which have resulted in the leakage of the reservoir and possible remedies are being investigated by the reclamation service.

The rock formations are the 'red beds' of the plains which in this region contain strata of gypsum to a depth of 1,500 feet. Rock salt occurs in large amounts near Carlsbad and the distribution of salt springs indicate that it may have formerly extended throughout the Carlsbad region. Sink holes exist wherever the gypsum occurs near the surface in the vicinity of the river. These sinks connect with caverns formed by solution of the gypsum beds and they are numerous enough to warrant the assumption of a general honeycombed condition throughout the gypsiferous formation. Removal of the soluble strata and the falling in of the caverns produced must undoubtedly have permitted a gradual depression of the surface of the ground, and it is suggested that this process has been the effective cause in producing the basins in the valley near Carlsbad. This hypothesis has been applied by Mr. C. A. Fisher, of the United States Geological Survey, to account for the origin of the Roswell Basin north of Carlsbad, where the fractured and insoluble mass of residual strata is reported to be more than 1,000 feet in depth. In the Carlsbad region details have not been worked out, but the insoluble strata are undoubtedly in a fractured condition, allowing free circulation of water under ground. In part, at least, the water which runs into the ground at the McMillan reservoir returns to the surface above Carlsbad. In the case of one large spring below the dam the rate of flow depends upon the height of water in the reservoir, but it is by no means certain that the supply of this spring is entirely leakage from the reservoir.

Glacial Phenomena in the San Juan Mountains: Mr. Ernest Howe.

In addition to the drift that has long been recognized in the San Juan Mountains, certain detritus has been observed at various places that is evidently older, but in regard to the origin of which information has hitherto been lacking. Quite recently evidence has been found in the Uncompahgre Valley which suggests that certain of these deposits may be of glacial origin.

The events of the later stage of glaciation are recorded in a slight but characteristic modification of the topography, and in an abundance of drift in the form of moraines and outwash gravels, oxidized but little, and upon which subsequent erosion has had slight effect. Post-glacial erosion has been insignificant in the higher mountains, and it is believed that glacial conditions continued to exist until comparatively recent times.

The older detritus occurs farther from the mountains than the more recent material and rests upon the remnants of an old topography that was deeply dissected prior to the last stage of glaciation. The form of the deposits suggests that they have undergone much modification, and the materials composing them have been more or less decomposed by atmospheric agents. The evident greater age of this detritus is in strong contrast to that of the drift deposited by the last glacial ice. The large size of individual boulders, the heterogeneous character of the material and the distance from its source suggest transportation and deposition by glaciers as an explanation of the origin of these deposits.

Stratified deposits of water-worn gravels, closely related to the older drift in age and position, extend far out from the mountains

and are regarded as outwash deposits incident to the earlier glaciation. Between these highest gravels and the valley train of the last stage of glaciation several intermediate gravel-covered terraces occur that are believed to have been developed during the period of interglacial erosion which accomplished the dissection of the old surfaces upon which the early drift was deposited.

ARTHUR C. SPENCER,
Secretary.

THE TORREY BOTANICAL CLUB.

A MEETING of the club was held on January 9, at the American Museum of Natural History, with President Rusby in the chair. Sixteen persons were present.

The annual reports of the treasurer, secretary, corresponding secretary, editor and the editor of *Torreya* were then read and placed on file. The committee on phanerogams, and the committee on cryptogams reported progress.

The following officers were elected for the ensuing year:

President—Dr. H. H. Rusby.

Vice-Presidents—Dr. Edward S. Burgess, Professor L. M. Underwood.

Recording Secretary—Dr. C. Stuart Gager.

Corresponding Secretary—Dr. John K. Small.

Editor—Dr. John Hendley Barnhart.

Treasurer—Dr. Carlton C. Curtis.

Associate Editors—Dr. Alex. W. Evans, Dr. Tracey E. Hazen, Dr. Marshall A. Howe, Dr. D. T. MacDougal, Dr. W. A. Murrill, Dr. Herbert M. Richards, Anna Murray Vail.

A request from Mrs. E. G. Britton for a grant of $100 from the Herrman fund to be used in illustrating new species of mosses from the southern states and the West Indies was read and the application approved by the club.

C. STUART GAGER,
Secretary.

THE ELISHA MITCHELL SCIENTIFIC SOCIETY OF THE UNIVERSITY OF NORTH CAROLINA.

THE 162d meeting was held in the chemical lecture room, on Tuesday, January 23, 7:30 P.M. Under the topic 'Tropical Notes,' Professor W. C. Coker described in a most interesting way a recent botanical trip to southern Florida and Cuba. Numerous specimens of plants were exhibited. The program was concluded by Professor Archibald Henderson, who discussed 'A Group of Cross Ratios.'

A. S. WHEELER,
Recording Secretary.

DISCUSSION AND CORRESPONDENCE.

ECOLOGICAL ADAPTATION AND ECOLOGICAL SELECTION.

IT seems that in the recent discussion of evolution there is too much importance attached to variation. It is not so certain that variation itself, or the elucidation of the question how certain species came to have certain characters, is the most important question in the origin of species. The segregation of species may be only an ecological process in which the matter of structural variation is of secondary importance. In fact the Darwinian theory does not require the supposition that the origin of a new species begins with a change of structure, so that to insist upon the importance of ecological selection is only to emphasize a factor already recognized by Darwin. By limiting the development of species to the assumption of structural characters the theory of natural selection is made to appear at an unfair disadvantage. Species are characterized by non-competitive habits rather than by adaptive structures. Indeed, I hold that the origin of a new species begins with a change of place or habits and that the characters by which species are distinguished, as well as adaptive structures, follow as a consequence.

In the 'Origin of Species' there are several passages in which a change of habits is specified as a condition of selection. "For as all of the inhabitants of each country are struggling together with nicely balanced forces, extremely slight modifications in the *structure or habits* of one species would often give it an advantage over others" (p. 64). "The more diversified the descendants from any one species become in *structure, constitution and habits*, by so much the more will they be en-

abled to seize on many and widely diversified places in the polity of nature, and so be enabled to increase in numbers" (p. 87). "The more diversified in *habits and structure* the descendants of our carnivorous animals become the more places they will be enabled to occupy" (p. 88). "I will now give two or three instances both of diversified and of changed *habits* in the individuals of the same species. In either case it would be easy for natural selection to adapt the *structure* of the animal to its changed *habits,* or exclusively to one of its changed *habits.* It is, however, difficult to decide, and immaterial for us, whether *habits* generally change first and *structure* afterwards" (p. 141). In view of the fact that in the ordinary cases the changes of structure are not adaptive, it seems to me quite material to recognize the change of habits as in itself adaptive and as an important condition of selection. "He who believes in the struggle for existence and in the principal of natural selection will acknowledge that every organic being is constantly endeavoring to increase in numbers; and that if any one being varies ever so little, in either *habits or structure,* and thus gains any advantage over some other inhabitant of the same country, it will seize on the place of that inhabitant, however different it may be from its own place. Hence it will cause him no surprise that there should be geese and frigate birds with webbed feet living on dry land and rarely alighting on the water; that there should be long-toed corncrakes living in meadows instead of in swamps; that there should be woodpeckers where hardly a tree grows; that there should be diving thrushes and diving Hymenoptera, and petrels with the habits of hawks" (p. 145). These quotations may give an idea of Darwinism quite different from that suggested by some current definitions which the authors have not felt obliged to connect with Darwin's writings.

By ecological adaptation is meant the kind of adaptation which occurs when a species occupies a favorable position without showing any obvious adaptive characters, except such as are common to other members of the same genus or larger group. By ecological selection is meant the kind of selection which is conditioned upon the species occupying a favorable position without developing any obvious adaptive characters.

No ecological position is favorable for an unlimited number of individuals. The multiplication of species results from the fact that the dominant species produce more individuals than can occupy the same position. Whenever the number exceeds the optimum, even when there is no kind of inferiority among the individuals, wholesale extermination must occur, or some of the individuals must avoid competition with the dominant form by a change of place or habits.

Change of place seems to be the easiest and most natural means of avoiding competition and one of the most obvious conditions of selection. I am inclined to regard this as the most important factor and the one which will explain the most cases. I think the students of geographical distribution can show a thousand incipient species where the mutationists can show a doubtful one. In a local fauna it is remarkable how few species belong to the same genus. It is almost certain that the nearest relatives of any form will be found outside the district. The homogeneous elements diverge from a given habitat and the heterogeneous elements converge there. What happens to the migrating form seems to me of less importance, if it can be shown that the migration was a condition of selection. This may be hard to show. It is obvious enough, if we contemplate the return of all of the forms to their original starting point. Modification of the geographical segregate by the intercrossing of its more or less isolated members, by the operation of the selective conditions of the new environment, or by the local influences which give an impress to large elements of the fauna, are all secondary to the selective conditions which induced the migration.

But a considerable proportion of species may have originated in the same place. In this case the condition of selection is the adoption of habits which relieve them from the pressure of competition with the dominant forms. If a form occupies a favorable posi-

tion, it will produce a great number of individuals forming what we call a common and polymorphic species, probably more or less variable in habits, or polytropic. When the number of individuals approaches the maximum, the pressure of competition increases until the position becomes unfavorable to a certain proportion of the individuals. The pressure is least on the set of individuals having the most divergent habits. There is a tendency for the polymorphous polytropic group to break up into a number of more uniform oligotropic groups. If the parent species is itself oligotropic, it may give rise to a form of quite different habits. The original form retains the original position and the derived form changes to a new position. Usually all that is required to place a form in an absolutely new ecological position and make it the progenitor of a varied line of descendants is a mere change in the kind of food. The assemblage of bees owes its existence to the fact that some aculeate hymenopteron abandoned the pursuit of other insects and provisioned its nests with honey and pollen.

Whenever competition becomes severe, natural selection may operate upon two sets of individuals, those which have the original habits and those which show a change of habits. In the first set it retains the most perfectly adapted individuals. This merely keeps the original species adjusted to the original habits. The second set becomes the new species and natural selection may further operate to fit it to the new habits. When an old organ is used for a new purpose, we can understand how, after competition has again become severe, individuals in which the organ is best fitted for the new use will have the advantage. The theory of natural selection itself as applied to adaptive structures implies that the development of a new organ is preceded by a change of habits, for how is natural selection to improve an organ for a certain purpose unless the organ is already being used for that purpose?

Those who attach so much importance to structural modifications as a condition of selection seem to me to overlook an important element in the nature of adaptation. Adaptation is determined by the nature of the position as well as by the presence of structures fitting the organism for it. The bird which became the progenitor of the humming birds was better adapted to its new place than any of its more modified descendants, not because it was structurally better fitted to get nectar from flowers, but because it occupied a more favorable place. The favorable nature of this place is shown in the fact that it could produce 400 specific forms in a comparatively short time. The absence of adaptive structures does not show that a species is wanting in adaptive habits of the most distinct kind. It does not show that natural selection has been any less operative in producing segregation.

As an example of ecological adaptation I may mention several species of the bee genus *Colletes* which occur in my neighborhood. They are distinguished by structural differences of the labrum, antennæ, metathorax, by size and punctation and by the color and arrangement of the hair. The proboscis and pollen-carrying apparatus are the same in all, and, as far as I can see, the species do not have any adaptive structural differences. The nine species so differ in habits and in seasonal distribution that only three are in competition. *C. inæqualis* is polytropic and flies from March 20 to May 31. *C. æstivalis* gets its pollen exclusively from *Heuchera hispida* and flies from May 8 to July 1. *C. brevicornis* is an oligotropic visitor of *Specularia perfoliata* and flies from May 29 to June 29. *C. willistonii* flies from May 28 to September 5, and *C. latitarsis* from June 13 to September 29. Both of these are competitors for the pollen of *Physalis,* but they are not closely related. *C. latitarsis* is more common and its flight begins and ends later. *C. eulophi* flies from May 28 to October 9. It is polytropic, but gets most of its pollen from Compositæ. It is a competitor of the following species only in 40 per cent. of its days and in 22 per cent. of its observed flower visits. Three species are autumnal and get their pollen exclusively from Compositæ: *C. armatus,* August 17 to October 7; *C. americanus,*

August 18 to October 23; *C. compactus*, August 26 to October 19. The times of flight of the three species nearly coincide and they are competitors in the order named by 80 per cent., 66 per cent. and 45 per cent. of their observed visits. According to the views expressed here, three closely related species having the same habits would not be expected to originate in the same neighborhood. A species having an abundant food supply will simply increase in the number of individuals. The three species above mentioned are not closely related. They have evidently become competitors by migrating from the outside.

In *Andrena* there are three species, each an oligotropic visitor of willows and each having a form, or closely related species, in which the female has the abdomen red. At least as far as these species go, it will refute my view if it can be shown that the red form indicates the development of a new species having the same habits and the same range. I regard the red form as a southern geographical race, or species, and hold that the forms in their distribution merely overlap here.

The views here stated may be expressed in the following propositions:

1. To occupy the same ecological position two species must have the same geographical and phenological range and the same food habits.

2. No ecological position is favorable for an unlimited number of individuals.

3. The origin of new species results from the fact that the dominant species produce more individuals than can occupy the same position.

4. Natural selection then operates in favor of any set of individuals which changes habitat or habits so as to avoid competition with the dominant form.

5. The dominant form retains the original position.

6. The new form becomes specialized in adjustment to the new position.

7. The least specialized members of a group occupy the original position. The specialized members of a group have not driven out the original forms from the original position, but have been driven out by them. The highest specialized members are the ones which have most frequently been driven out of their positions by the competition of lower forms.

8. Specific characters usually are not adaptive.

9. Specific characters are the result of the intercrossing of the members of an ecological segregate and are the result rather than the cause of the segregation.

10. Adaptation to a position is determined by the nature of the position rather than by the characters fitting the organism for it. Usually it does not require the development of adaptive characters and usually is not associated with them.

11. Adaptive characters are the result of the operation of natural selection after the ecological segregation takes place and do not precede the occupation of the new position.

12. An ecological position is more favorable to a limited number of individuals with imperfect adaptive structures than to a great number of individuals having more perfect structures.

13. An ecological basis for morphology is found in the change of habits which requires an old organ to be used for a new purpose. An ecological basis for evolution is indicated by the endless taxonomic difficulties resulting from adaptation to function.

14. Species having the same habits are produced by geographical migration.

15. Species having different habits are produced by ecological selection.

Charles Robertson.

'BARRIERS' AND 'BIONOMIC BARRIERS'; OR ISOLATION AND NON-ISOLATION AS BIONOMIC FACTORS.

During the last three months there have appeared in Science a most interesting series of communications, contributed by both zoologists and botanists, on the influence of isolation as a factor in the evolution of species and subspecies. While there has been some disagreement as to the facts in the case, especially from the side of the botanists, the zoologists appear to differ mainly in respect to the application of terms to phenomena about the existence and relations of which there is practically

no disagreement. Following President Jordan's original statement of the case in the issue of SCIENCE for November 3, 1905, and my own comment thereon in the issue for November 24, 1905, is a communication by Professor E. A. Ortmann, in the issue for January 12, 1906, entitled 'Isolation as One of the Factors in Evolution,' about which I wish to offer a few words in the way of comment.

In this communication Professor Ortmann states, apropos of the previous papers by Jordan and myself, that he 'can not strongly enough endorse' Jordan's view 'that isolation is a factor in the formation of every species on the face of the earth'; 'for,' he continues, 'it is absolutely unthinkable that two species may be derived from one ancestral species without the action of isolation.' To continue the quotation further, Ortmann says:

All the instances introduced by Allen as opposed to this view are rather in support of it. He concludes that in variations of certain widely distributed species, which pass into each other from one extremity of the range to the other, no isolation by barriers exists, but that there is continuous distribution. Indeed, there is continuous *distribution*, but there is no continuity of *bionomic conditions*. These different bionomic conditions pass into each other, and, consequently, we have varieties, and not species. This is clearly the first step toward complete isolation, and for complete isolation 'barriers' in most cases are not absolutely necessary features.

Under the new definitions of 'barriers' and 'isolation' this may, in large part, be conceded as true, but as not wholly true, even under these new premises. If President Jordan originally meant by isolation and barriers 'bionomic isolation' and 'bionomic barriers,' as he has since stated that he did,[1] and as Professor Ortmann now claims that he did, instead of isolation and barriers as commonly accepted by students of the geographic distribution and geographic evolution of animals, the case is, of course, quite changed by the afterthought of fuller definition. It may, further, explain Ortmann's statement that my presentation of the case 'demonstrates again that the principle of isolation or separation is not generally understood in its full meaning.'

[1] SCIENCE, N. S., Vol. XXII., No. 570, p. 715.

But let us consider for a moment just what are the real facts covered by the statement: 'Indeed, there is continuous *distribution*, but there is no continuity of biologic *conditions*.'

Students of the geographic distribution and geographic or climatic evolution of species and subspecies, and also of minor local variants, among North American birds and mammals, both in the field and through handling vast numbers of museum specimens, are, perhaps, as familiar with the general facts of geographic variation as are investigators in any other field of biology. Let us apply a little of this 'common knowledge' to the statement that "for complete isolation 'barriers' in most cases are not absolutely necessary features." We may take for illustration any one of hundreds of conspecific groups, such as the song sparrows, the quails, grouse, woodpeckers, ground squirrels of several genera, tree squirrels, hares, field mice of various genera, etc., where an intergrading group of well-marked geographic forms has collectively a continuous range of hundreds, and often of several thousand miles in, it may be, both an east and west and a north and south direction. The extremes, or the peripheral forms, are so diverse in size, coloration, food habits, etc., that if one of these extreme forms were to be transferred to the home of the other it would be impossible for the two to intermingle through interbreeding, or for either to survive the changed conditions of environment. Yet between them there is no impassable physical barrier to continuous distribution, nor any break in the continuity of intergradation. Between such forms there is evidently a *bionomic barrier*. They have, indeed, become so divergent that were the connectant forms swept out of existence over a wide area by an epidemic of disease, or by some topographic or climatic change of conditions, the surviving extremes of the series could be considered by systematists in no other light than as fully segregated and sharply defined species.

But how is it between two contiguous and less differentiated forms? In eastern North

America, from the Gulf of Mexico to Alaska, there are no abrupt and insuperable barriers, either topographic or climatic, to the continuous distribution of many forms of life; the diversity of conditions, due primarily to climate, however, is so great that few, if any, species of mammals range throughout this whole area, or of birds that have a breeding range of this great extent. Each climatic zone has its peculiar associations of life, made up by the overlapping of the ranges of different sets of species, whose final boundaries are formed for each by a particular combination of climatic conditions. Aside from the temperature zones, just considered, other climatic factors, as especially that of rainfall, become active in passing from the eastern border of the United States westward to the Rocky Mountains and the Pacific coast. There thus arise a large number of faunal areas aside from those dependent on zones of temperature. The transition between these also is not sufficiently abrupt, except where locally complicated with topographic barriers, to prevent the continuous distribution of many species of birds and mammals. But the transition at certain points between contiguous forms is much more rapid over certain comparatively narrow belts than elsewhere. If we take some central point in the eastern United States, as for instance Columbus, Ohio, we may go east, west, north or south for several hundred miles in an area where the amount of local or climatic differentiation is so small as to be practically indistinguishable; in other words, we are in the central portion of a large area where the conditions of life are comparatively uniform, and are reflected in the practically constant characters—color, size, etc.—of its animals. If, however, we pass westward to about the ninety-eighth meridian, on the same parallel, we meet with wholly different conditions; we are then in a transition belt, where the characters of the animals are unstable; we have left the eastern phases of many of the mammals that range continuously westward, but have not yet reached the Great Plains phases that come in and for a long distance take their place as stable western forms representing the equally stable eastern forms we have left behind. We are in a comparatively narrow belt of intermediates—in some respects the *bête noir* of the systematist, in others constituting an invaluable key to otherwise intricate problems in evolution—which in turn reflect the action of intermediate conditions of environment between two well-marked areas. There is no barrier, topographic, climatic, or even bionomic, under any reasonable use of these terms; the transition belt is narrow, seldom more than thirty to fifty or a hundred miles in width; there is every opportunity for interbreeding, and no barrier other than the sedentary disposition of individual animals. If this fulfills Professor Ortmann's definition of 'no continuity of bionomic conditions,' and meets President Jordan's definition of 'isolation,' we at least understand each other.

J. A. Allen.
American Museum of Natural History,
New York City,
January 21, 1906.

SPECIAL ARTICLES.

ON THE BREAKING-UP OF THE OLD GENUS CULEX.

Within the past two years attempts have been made to break up the old genus *Culex* into smaller genera based chiefly or wholly upon the structure of the claspers of the male. That too great stress has been laid upon this character in many cases is the opinion of more than one systematic worker in the Diptera. Thus such very closely related species as *sylvestris* and *cantator* are separated into distinct genera, while, on the other hand, such very diverse forms as *sollicitans, squamiger, bigotii, annulatus, janitor* and *discolor* are placed in one and the same genus. In this as in other cases, any attempt at a classification founded upon a single character is certain to produce unsatisfactory results; only by taking into consideration the habits and entire life cycle of the various forms can anything approximating a natural grouping be formulated.

The writer has recently been able to make a long-contemplated study of the species of this country placed by Theobald in the genus *Culex* in the first two volumes of his mono-

graph, with a view to the bringing about of a more natural grouping of these forms, for use in a circular soon to be issued by Dr. L. O. Howard; as the character of that publication precludes the giving of an exposition of the subject, it has been thought best to give this in the pages of SCIENCE.

I first made a critical study of the members of this genus in the year 1895,[1] and was impressed with the importance of the structure of the tarsal claws of the female—whether toothed, or simple—and later began all of my published synoptic tables of the species with this character. The present study has but confirmed the correctness of that first impression—that all of the species with simple claws in the female are more nearly related to each other than they are to any species in the series having the claws toothed, and *vice versa*. Several months ago Miss E. G. Mitchell expressed the opinion that those species which lay their eggs in masses form a natural group by themselves, and stated that their larvæ possess important structural characters not found among those belonging to the single-egg group. That the difference in the manner of egg-laying is an important one admits of no argument; even the enveloping membrane is structurally different in the two kinds of eggs. Applying the egg-laying habit, so far as this is at present known, to the members of the two tarsal-claw groups, it was ascertained that all those with toothed claws deposit their eggs singly, while those with simple claws lay their eggs in masses with the exception of a single genus (*Grabhamia*). This was sufficient agreement to indicate an evident correlation existing between the egg-laying habits and the character of the tarsal claws. Next, by taking jointly the more prominent characters from both adults and larvæ a rational and natural grouping resulted, as may be seen by reference to the accompanying table:

A. Tarsal claws of the female simple, scales of the mesonotum and the outstanding ones on the wing veins narrow and almost linear.

B. Eggs laid in masses. Larva having more than one pair of tufts or of single hairs on the breathing tube, or else with ten or more bristles in continuation of the two rows of spines. Tarsi of the adult white at each end of some of the joints, or else wholly black, in which latter case the abdomen is black scaled, sometimes with basal light colored bands on the segments.

C. Hind cross-vein of the wings more than its own length distant from the small, palpi of the male exceeding the proboscis by more than the length of the last joint, densely long-haired. Larva with more than one pair of tufts or of single hairs on the breathing tube, the two rows of spines never continued by bristles, antennal tuft situated in a distinct notch (*pipiens*, etc.).
Culex Linné.

CC. Hind cross-vein less than its length from the small, palpi of the male scarcely exceeding the proboscis, sparsely short-haired. Larva with only one pair of tufts on the breathing tube, situated close to its base, the two rows of spines continued by ten or more bristles, antennal tuft never in a notch.

D. Scales of the wings uniformly distributed (*absobrinus*, etc.).
Culiseta Felt.

DD. Scales much more dense on some portions of the veins than on other portions (*annulatus*, etc.).
Theobaldia Nev. Lem.

BB. Eggs laid singly. Larva having only one pair of tufts on the breathing tube, the two rows of spines composed of from four to six spines each, the rows never continued by bristles, spines on either side of the eighth segment of the abdomen very large, from four to six in number, arranged in a single row. Tarsi of the adult white at the bases only of some of the joints, or else wholly black, in which case the abdomen is black scaled and with the front corners of the segments white scaled (*jamaicensis*, etc.).
Grabhamia Theob.

AA. Tarsal claws of the female toothed in at least the front and middle feet. Eggs laid singly. Larva with only one pair of tufts on the breathing tube (except in *cinereoborealis*), the two rows of spines composed of ten or more rather small ones in each row, the latter not continued by bristles.

E. Scales of the mesonotum narrow, almost linear.

F. Outstanding scales of the wing-veins nar-

[1] See the *Canadian Entomologist* for 1896, page 43.

row, only slightly tapering toward their bases (*confirmatus*, etc.).
Ochlerotatus Arrib.

FF. Outstanding scales chiefly very broad, strongly tapering toward their bases, several of them emarginate at their apices (type, *squamiger*). *Lepidoplatys* n. gen.

EE. Scales of the mesonotum chiefly rather broad, obovate, outstanding scales of the wing veins narrow (type, *cyanescens*).
Lepidosia n. gen.

For want of knowledge of the egg-laying habits, the genus *Culicella* is omitted from the above table; also the genera *Melanoconion* and *Pneumaculex*, both of which have rather broad scales on the wing veins. The synonymy of the other proposed names, so far as these can be made out at the present writing, is as follows:

Culex Linné: *Heteronycha* Arrib., *Neoculex* Dyar.

Grabhamia Theob.: *Feltidia* Dyar.

Ochlerotatus Arrib.: *Culicelsa, Culicada, Ecculex* and *Protoculex* Felt; *Pseudoculex* Dyar and *Grabhamia* Dyar (not of Theobald).

D. W. Coquillett.

U. S. National Museum,
January 19, 1906.

IMPORTATIONS OF THE PRICKLY PEAR FROM MEXICO.

The United States Department of Agriculture, through the Office of Grass and Forage Plant Investigations, has within the past three months made some large importations of species of economic cacti from the plateau region of Mexico. There is probably no region in the world where these plants are of so much importance as food for man and beast as they are in the great highland region of this republic. While some of the recent accounts of these plants which have appeared in the popular journals are spectacular and much overdrawn, there is still a great deal of well-founded popular and scientific interest in the prickly pears in this country. The importance of the prickly pear in the region above mentioned is apparent to all who have traveled in Mexico and observed Mexican habits and customs at all closely during any season of the year, for there is scarcely a day throughout the year that the fruits, to say nothing of portions of the plants themselves, are not offered for sale on some of the markets in the cities of the republic.

The following brief list of imported varieties will serve as an illustration of the wealth and variety of material which the Mexican people have at their command: Nopal aguamielillo, nopal amarillo, nopal amarillo-blanco, nopal amarillo-liso, nopal arton, nopal blanco, nopal blanco-liso, nopal charol, nopal caidillo, nopal camueso, nopal cardon, nopal cardon-blanco, nopal castillo-blanco, nopal cascaron, nopal cenizo, nopal chamacuero, nopal chaveño, nopal cochinero, nopal cogonoxtle (cardencha), nopal colorado, nopal cristalino, nopal cuijo, nopal duraznillo, nopal duraznillo blanco, nopal duraznillo colorado, nopal fafayuco, nopal huevo de perro, nopal encarnadillo, nopal jarillo, nopal jocoquilla, nopal joconoxtle, nopal joconoxtle-chato, nopal joconoxtle-cuaresmaro, nopal leonero, nopal liso, nopal loco, nopal mameyo, nopal manso-morado, nopal naranjado, nopal negrito, nopal opalillo (apalillo), nopal pachon, nopal palamito, nopal paloalteño, nopal San Juanero, nopal sarco, nopal tapon, nopal tapon liso, nopal teca, nopal temperanillo, nopal vinatero, nopalito de jardin. About as many more unnamed economic forms in addition to the above have been imported.

Some of the above popular names refer to the same plant, being different appellations for the same thing from different localities, and others are varietal names only, but it is believed that the majority of them represent good botanical species.

David Griffiths.

U. S. Department of Agriculture.

CURRENT NOTES ON METEOROLOGY.

MOISTURE FOR HEATED HOUSES IN WINTER.

The dryness of the air in our furnace or steam-heated buildings in winter has often been referred to, and has also been experimentally investigated. Recently Mr. G. A. Loveland, section director of the Nebraska Climate and Crop Service, has made some cal-

culation regarding the amount of water needed to moisten the air indoors to a reasonable degree (*Mo. Weather Rev.*, XXXIII., 208). He finds that in southeastern Nebraska, in a house containing 14,000 cubic feet, from twenty to forty quarts of water should be evaporated daily. This amount of evaporation does not increase the relative humidity by more than ten per cent. Experience has shown that, under the conditions of Mr. Loveland's experiments, the humidity indoors should not exceed forty per cent., otherwise condensation on windows will be troublesome. Double windows doubtless allow a greater increase in humidity without the disagreeable result here referred to. The ten per cent. increase makes a decided difference in the feeling of the air. The temperature of the room was kept about as high with the added moisture as if the air had been drier. (In some experiments made a few years ago by Dr. Henry J. Barnes, of Boston, the moisture added to the air by means of a 'humidifier' made the room comfortable at a temperature several degrees lower.)

ROYAL METEOROLOGICAL SOCIETY.

RECENT meetings of the Royal Meteorological Society, as reported in the *Quarterly Journal* of the society, brought out several papers of general interest. An address on 'The Growth of Instrumental Meteorology,' by Richard Bentley, laid emphasis on the seven great weapons of the meteorologist, the thermometer, hygrometer, rain gauge, barometer, anemometer, kite and heliograph, and directed attention to our indebtedness to Italy in this science, as in others. W. H. Dines, in 'An Account of the Observations at Crinan in 1904, and Description of a new Meteorograph for use with Kites,' reported upon the kite work carried on under the direction of a joint committee of the Royal Meteorological Society and of the British Association. During the summer of 1904 a naval vessel was placed at the disposal of this committee by the Admiralty. Richard Strachan, in a paper on 'Measurement of Evaporation,' thought it desirable to estimate, even empirically, the probable amounts of evaporation and percolation. 'Normal Electrical Phenomena of the Atmosphere' were discussed by George C. Simpson, who stated the chief lines along which investigations have been made during the last few years, the conclusions arrived at, and the chief problems awaiting solution. A paper by S. P. Fergusson, of Blue Hill Observatory, described the automatic pole star recorder, and the ombroscope in use at Blue Hill. The latter instrument records with great exactness the time of commencement and the duration of rain.

ANNUAL RINGS OF TREE GROWTH.

IN the *Monthly Weather Review*, Vol. XXXIII., 1905, 250–251, Professor E. E. Bogue, of the Agricultural College at Lansing, Mich., gives the results of an investigation made by him of the seasonal and annual rapidity of growth of trees in Stillwater, Okla., between October, 1898, and September, 1901. Twenty-seven trees were studied, nearly all of them being yearlings or two-year-olds. The results show that there was a close relation between rainfall and tree growth. At Lansing, Mich., an investigation was made into the average width of the annual rings of growth of forty-two trees, during the period 1892 to 1904, in relation to the annual precipitation. The data show that a precipitation of 30 to 35 inches gives a width of ring of from 0.11 to 0.15 inch, and that abnormally large or small precipitation is evidenced by the tree growth of the following year.

CLOUD STUDIES IN THE PYRENEES.

THE results of detailed cloud studies carried on at the Pic du Midi Observatory and at the base station, Bagnères, have been discussed by Marchand (*Met. Zeitschr.*, Nov., 1905). Of general interest may be noted the following conclusions. Three different elements occur in clouds: (1) Water drops; (2) small, more or less crystalline ice particles, without definite forms; (3) small, regular, transparent hexagonal crystals (plates, stars, needles, etc.). Cirrus and cirro-stratus are composed of the third of these elements. Cirro-cumulus clouds also contain these crystals, but probably are chiefly made up of ice particles of distinct

crystalline form and much less frequently of sub-cooled water drops. Cumulus, nimbus, stratus, alto-cumulus and strato-cumulus are composed of water drops, which may be sub-cooled, or of ice pellets, sometimes mixed with small regular crystals.

INVESTIGATION OF THE UPPER AIR IN ENGLAND.

Nature (December 14, 1905) reports that the Meteorological Committee has assigned from the parliamentary grant under its control a sum for promoting the investigation of the upper air by kites and other means. It is proposed to establish an experimental station for kite ascents and other experimental investigations; to develop and extend the instrumental equipment, so that facilities may be afforded for the cooperation of other observers upon sea and land, and to provide for the publication of the observations. Mr. W. H. Dines will undertake the direction of the operations for the Meteorological Office. The cooperation of marine observers will be enlisted, and several offers of assistance in the work at land stations have already been received.

TEMPERATURE AND RELATIVE HUMIDITY DATA.

Bulletin O of the United States Weather Bureau contains a useful collection of data concerning the temperature and relative humidity of the United States. The tables include the following: highest and lowest temperatures recorded at Weather Bureau stations for each month (with charts); monthly and annual mean maximum and mean minimum temperatures; monthly and annual mean relative humidity. If we are not mistaken, these data have all been published in the 'Annual Reports of the Chief of the Weather Bureau,' but it is very convenient to have them in a separate *Bulletin,* of less bulky proportions than the annual reports.

R. DeC. Ward.

THE CONGRESS OF THE UNITED STATES.

January 15.—The Secretary of the Treasury transmitted a communication from the Secretary of the Interior, submitting an estimate of appropriations for the International Seismological Association. Referred to the Committee on Appropriations of the House of Representatives.

January 26.—Mr. Lacey introduced a bill in the House to protect birds and their eggs in game and bird preserves. Referred to the Committee on Public Lands.

Mr. Babcock introduced a bill to prohibit the killing of birds and other wild animals in the District of Columbia. Referred to the Committee on the District of Columbia.

January 30.—Mr. Cushman introduced a bill for the protection and regulation of the fisheries of Alaska. Referred to the Committee on the Territories.

February 1.—A bill to establish a fish-cultural station in the state of Utah was considered as in committee of the whole. It proposes to appropriate $25,000 for the establishment of a fish-cultural station in the state of Utah, including purchase of site, construction of buildings and ponds, and equipment, at some suitable point to be selected by the Secretary of Commerce and Labor. The bill was passed in the Senate.

A bill to appropriate the sum of $25,000 under similar conditions to those of the first bill, to establish a fish-cultural station in the state of Wyoming, was also passed.

A bill to establish one or more fish-cultural stations on Puget Sound, state of Washington, was considered as in committee of the whole. It proposes to appropriate $50,000 for the establishment of one or more fish-cultural stations on Puget Sound, state of Washington, for the propagation of salmon and other food fishes, including purchase of sites, construction of buildings and ponds, purchase and hire of boats and equipment, and such temporary help as may be required for the construction and operation of the fish-cultural stations, at a suitable point or points to be selected by the Secretary of Commerce and Labor, the number of fish-cultural stations to be determined by the Secretary of Commerce and Labor. Passed in the Senate.

February 8.—The bill to establish a fish-cultural station in the city of Fargo, North Dakota, passed the Senate.

The act to provide for the protection of the salmon fisheries of Alaska, approved June 9, 1896, was amended in the Senate by the passage of the following section:

Sec. 2. That it shall be unlawful to fish, catch, or kill any salmon of any variety, except with rod or spear, above the tide waters of any of the creeks or rivers of less than 500 feet width in the Territory of Alaska, except only for purposes of propagation, or to lay or set any drift net, set net, trap, pound net, or seine for any purpose across the tide waters of any river or stream for a distance of more than one third of the width of such river, stream, or channel, or lay or set any seine or net within 100 yards of any other net or seine which is being laid or set in said stream or channel, or to take, kill, or fish for salmon in any manner or by any means in any of the waters of the Territory of Alaska, either in the streams or tide waters, except Cook Inlet, Prince William Sound, Bering Sea, and the waters tributary thereto, from midnight on Saturday of each week until midnight of the Sunday following; or to fish for or catch or kill in any manner or by any appliance, except by rod or spear, any salmon in any stream of less than 100 yards in width in the said Territory of Alaska between the hours of 6 o'clock in the evening and 6 o'clock in the morning of the following day of each and every day of the week.

The bill to prohibit aliens from taking fish from the waters of the District of Alaska, passed the Senate.

The House bill authorizing the Secretary of the Interior to lease land in Stanley County, South Dakota, for a buffalo pasture, was reported from the Committee on Public Lands, of the House, and referred to the Committee of the Whole.

THE COMING MEETING OF THE MUSEUMS ASSOCIATION OF AMERICA.

ON the fifteenth of May, at the American Museum of Natural History, Central Park, New York, a meeting will be held in order to organize 'The Museums Association of America.' Already the administrative heads of almost all of the more important museums, both of art and of natural history, in the United States and Canada have signified their intention, if possible, to be present at this meeting, and many have signified their purposes to read papers upon important subjects connected with the work of museums. The trustees of the Botanical Garden in Bronx Park have invited those attending this preliminary meeting to accept their hospitalities during one day's session, and have tendered a luncheon to the association. The committee of arrangements desires all who may be connected with museums in official capacities, or who take an interest in the work of museums, and who may desire to enroll themselves in such an organization, to signify that fact to the undersigned, who will, upon receipt of an intimation of their desire to be enrolled as members of the association, send to them at once the proper papers to be filled out.

It is hoped that this invitation will meet with a general response. W. J. HOLLAND.

THE CARNEGIE MUSEUM,
PITTSBURG, PA.

SCIENTIFIC NOTES AND NEWS.

A BILL granting permission to Professor Simon Newcomb, U. S. N., to accept the decoration of the order 'Pour le Mérite, für Wissenschaften und Kunste,' tendered by the emperor of Germany, passed the senate on February 8.

M. H. DE CHATELIER, professor of chemistry in the Collège de France, has been elected a corresponding member of the Berlin Academy of Sciences.

EMPEROR WILHELM has appointed Professor Ernst von Bergmann a member of the upper house of parliament (Herrenhaus) for life. This is the first time that such an honor has been conferred on a member of the medical profession.

DR. W. J. HOLLAND, the director of the Carnegie Museum, has accepted the invitation of the editor of the 'Encyclopedia Britannica,' London, to prepare the article upon Natural History Museums for the twelfth edition of the encyclopedia.

GLASGOW UNIVERSITY will confer its doctorate of laws on Robert E. Frasher, F.R.S., superintendent of the admiralty experiment works and member of the admiralty committee on warship designs.

The Argentine government has decided to continue the Scotia Bay Meteorological Station for still another year, and has appointed Mr. Angus Rankin, late of the Ben Nevis Observatory, to take charge. Mr. Rankin left Edinburgh for the south on October 11, and was accompanied by two other former members of the Ben Nevis staff, Mr. R. H. MacDougall and Mr. William Bee.

We learn from the *University of New Mexico Weekly* that President W. G. Tight, after about two weeks in the hospital, is recovering from the accident due to an explosion in his laboratory.

Dr. John B. Smith, professor of entomology at Rutgers College, has sailed for Europe, having been granted three months' leave of absence.

Professor W. R. Orndorff, of Cornell University, has left for a stay of several months in Europe. He will attend the World's Congress of Chemists at Rome in April.

Professor W. Z. Ripley, of the department of economics of Harvard University, has been given leave of absence for the second half-year.

Dr. Lewellys F. Barker, professor of medicine at the Johns Hopkins University, makes one of the principal addresses at the celebration of its thirtieth anniversary, on February 22.

A stated meeting of the Geographic Society of Chicago was held in the rooms of the Municipal Museum, in the Public Library Building, on February 9. An address was given by Professor C. K. Leith, of the University of Wisconsin, on 'The Iron Ore Resources of the Lake Superior Region.' The lecture was illustrated.

Professor S. A. Mitchell, of Columbia University, lectured before the New York Academy of Sciences on February 19 on 'The Total Eclipse of the Sun of August, 1905.' The lecture was illustrated by stereopticon views from photographs taken during the eclipse.

Dr. H. S. Jennings, of the University of Pennsylvania, has finished a course of five lectures before the Woman's College of Baltimore on 'The Behavior of Micro-organisms.'

Courses of lectures bearing on anthropology will be given this term at Oxford by Professor Tylor on 'Primitive Man,' by Mr. McDougall (Wilde reader) on 'Social Psychology,' by Mr. Bell on 'The Neolithic Age,' by Mr. Myres on 'Prehistoric Greece,' by Professor Vinogradoff on 'Early Legal Institutions,' and by Mr. Marett on 'The Social Institutions of Savages.' Informal instruction will also be given by Dr. Evans, of the Ashmolean Museum; by Mr. Balfour, of the Pitt Rivers Museum; by the professor of classical archeology and others.

The original date of the Sixth International Congress of Applied Chemistry has been changed from April 16, as stated in the issue of Science for January 26, to April 26, 1906.

At the Washington meeting of the International Geographical Congress in 1904, the invitation extended by the Swiss government and the Geneva Geographical Society to meet in 1908 in Geneva, was accepted. Steps are already being taken in Switzerland to set on foot the necessary preparations, and a circular has been issued by the Geneva Geographical Society announcing that the meeting will be held between July 27 and August 6, 1908. An organizing committee will shortly be formed, and it is hoped that a provisional program may be issued in the course of the year.

According to a despatch to the daily papers from Washington, the Carnegie Institution has purchased a tract of six acres in the northwest section of Washington, near Rock Creek Park, where it will erect a permanent home. The site is near the building of the United States Bureau of Standards, and is in a commanding position, overlooking the entire city. The purchase price was $3,500 an acre, and a building costing $100,000 will be erected at once.

Professor Flahault, director of the Botanical Institute of the University of Montpelier, has established by his own gift a mountain botanical garden on the slopes of l'Aigoual, at an altitude of thirteen hundred meters.

PROFESSOR WILLIAM JAMES and Dr. James H. Hyslop, vice-presidents of the American Branch of the Society for Psychical Research, have issued the following letter: "In the death of Dr. Richard Hodgson, the secretary of the American branch since its foundation, the society, as well as his personal friends, has suffered a great loss. The work of the branch, however, will be continued under the direction of its vice-presidents or those appointed by them for the purpose, until a satisfactory and efficient permanent arrangement can be made. In the meantime, it is important that past subscriptions to the society's work should be continued, and new ones obtained if possible, as there is a mass of documentary material collected by Dr. Hodgson which awaits the completed critical treatment he would have given it had he lived, and which should now be dealt with. And there are also certain new and important possibilities of investigation which have just come into sight."

ACCORDING to the *Scottish Geographical Magazine* a silver medal has been given by Mr. William S. Bruce to the members of the Scottish Antarctic Expedition, including the scientific staff, officers and crew of the *Scotia*, as well as the home staff, who have served throughout the expedition, as a token of appreciation of the work done by them. The obverse side represents the terrestrial globe floating in space swathed in clouds, showing especially the Atlantic Ocean and the neighboring American, European, African and Antarctic continents—the scene of the labors of the expedition. Below is the ship beset in heavy ice off Coats Land in 74.1° south latitude, with a typical flat-topped Antarctic iceberg in the background. Encircling this design is the legend, 'Scottish National Antarctic Expedition,' with a figure of St. Andrew and the Cross. The reverse side represents Omond House, built specially by the officers and crew of the *Scotia* at Scotia Bay, South Orkneys, showing the beach and the adjacent mountains. Encircling this is a wreath of thistles supported by two flags—one the Scottish Lion, the other the St. Andrew Cross with the letters S. N. A. E.—the expedition flag. Above is a scroll bearing the inscription, 'for valuable services' with the recipient's name. The dates 1902–1904 indicate the duration of the expedition.

THE daily papers state that the eruption of Mount Vesuvius is assuming alarming proportions. The funicular railway track has been damaged at six points, and the principal station is threatened with destruction. The authorities are taking precautions to prevent loss of life.

AN eruption of Mt. Etna began January 5. The *Corriere di Catania*, January 7, 1906, contains this notice:

The Royal Observatory sends the following communication: Etna, since the important eruptive manifestation of July–August, 1899, has, ending with yesterday, passed through a period of almost absolute inactivity, interrupted, now and then, by some very brief appearance of more or less emanations of white vapor from the central crater, which sometimes, but only rarely, assumed the form of slight eruptions, forming on the top of the mountain, crests which turned now in one direction, now in another, according to the direction of the high atmospheric current. Yesterday (5–6, January) there occurred a notable eruption of ashes from the central crater of Etna, which, falling on the white mantle of the recent snows, formed a long, wide, dark zone on the southern slope of Etna from the summit down to the region of Monte Nero, Passo Cannelli, etc., where the snow belt ends. The north wind carried the ashes as far as, and probably beyond, Catania, where on the terrace of the Observatory one could gather a considerable amount.

ACCORDING to a despatch from Washington to the Boston *Transcript*, dated February 13, New England experts in the extermination of the gypsy and brown tail moths were given a hearing before the house committee on agriculture, that morning. Efforts were centered in support of Representative Robert's bill providing $250,000 to be used under the direction of the Department of Agriculture cooperating with authorities of Massachusetts, Rhode Island, New Hampshire and Maine in exterminating the moths, $15,000 to be used in importing and distributing parasites. A. H. Kirkland, superintendent of the extermination work in Massachusetts; General Francis

Henry Appleton, of the State Board of Agriculture, and first vice-president of the Massachusetts Society for Promoting Agriculture; W. H. Gowker, member of the first 'moth' commission; Professor C. H. Fernald, state entomologist and member of the faculty of the Massachusetts Agricultural College; E. P. Hitchings, of Maine; H. J. Wheeler, of Rhode Island; E. Dwight Sanderson, of New Hampshire—all state entomologists—explained the serious conditions, the spread of the pest and the state efforts made to exterminate the moths. Dr. L. O. Howard, of the Agricultural Department, was present at the hearing. He confirmed the statement that Massachusetts has the best available methods for exterminating the moths in the parasites already placed in the infected sections as a result of his trip abroad. While yet a matter of experiment here, they have been effective in European countries.

The Peabody Museum, Harvard University, has recently acquired a fine collection of Indian relics from the northern coast of America, southern Alaska, British Columbia and northern California. They are the gift of Mr. L. H. Farlow.

UNIVERSITY AND EDUCATIONAL NEWS.

President Thomas, of Bryn Mawr College, has announced a gift of $80,000 from John D. Rockefeller, to enable the college to meet the expenses incurred by the trustees over and above the gift of $250,000, in 1902, for the new library. Mr. Rockefeller has contributed in all $455,000 to the fund that secured the library, the new dormitory and the heating and lighting plant. The total of this fund, including Mr. Rockefeller's gifts, is $738,-529.18.

McGill University receives $50,000 from the estate of the late Edwin H. King, former general manager of the Bank of Montreal. His widow recently died.

An equipment of microscopes for the department of physiology, College of Physicians and Surgeons, Columbia University, has been presented to this institution by Dr. David L. Haight, a graduate of the medical school in 1864.

The Rockefeller Hall of Physics, at Cornell University, will be dedicated at the beginning of July, during the Ithaca meeting of the American Association for the Advancement of Science.

By the will of Mr. R. C. Brereton, Cambridge University receives about £12,000 for the promotion of classical studies.

The electors to the Allen scholarship, of Cambridge University, are prepared to receive applications from candidates. A candidate must be a graduate of the university, whose age did not exceed 28 years on January 8, last. The scholarship is of the value of £250, tenable for one year only, the holder not being capable of reelection. This year the scholarship is open to candidates who propose to undertake research which comes within the department of any of the following special boards of study—namely, medicine, mathematics, physics and chemistry, biology and geology or moral sciences.

We learn from the *New York Evening Post* that in the College of Engineering of the University of Cincinnati, Melvin Price has been made professor of mechanical engineering. Professor Price is a graduate of Purdue, took advanced work in Columbia, and was recently head of the department of mechanical engineering in the University of Nebraska. E. L. Shepard, from the University of Missouri, has been appointed instructor in civil engineering.

I. C. Pettit is appointed instructor in electrical engineering, at Cornell University, in place of R. J. McNitt, resigned.

At Sheffield University, Mr. Louis Cobbett, F.R.C.S., has been appointed professor of pathology, and Mr. L. T. O'Shea, B.Sc. (Lond.), professor of applied chemistry.

The Journal of the American Medical Association states that Nothnagel's vacant chair, at Vienna, has been offered to Quincke of Kiel and to Strümpell, but each declined the honor. Minkowski of Griefswald and von Noorden of Frankfurt-on-the-Main were then proposed by the Vienna faculty of medicine, and late advices state that von Noorden has accepted.